

# MONITORING PROGRAM ANNUAL REPORT

## JANUARY - DECEMBER 2008

### ANCHORAGE WATER AND WASTEWATER UTILITY JOHN M. ASPLUND WATER POLLUTION CONTROL FACILITY AT POINT WORONZOF



Prepared for:



MUNICIPALITY OF ANCHORAGE  
Anchorage Water & Wastewater Utility  
Anchorage, Alaska

Prepared by:



**KINNETIC  
LABORATORIES  
INCORPORATED**

1102 WEST 7th AVE., ANCHORAGE, AK 99501  
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February 2009



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## **PREFACE**

This document is the Monitoring Program Annual Report required for submittal to the Environmental Protection Agency by NPDES Permit AK-002255-1 for discharge from the John M. Asplund Water Pollution Control Facility, operated by the Municipality of Anchorage at Point Woronzof. The NPDES permit incorporates provisions necessitated by a 301(h) waiver from the requirements of secondary treatment.

The elements of the monitoring program are:

- Influent, Effluent, and Sludge Monitoring
  - In-Plant Sampling
  - Toxic Pollutant and Pesticide Sampling
  - Pretreatment Monitoring
  - Whole Effluent Toxicity Monitoring
- Receiving Water Quality Monitoring
  - Plume Dispersion
  - Intertidal Zone Bacteria
- Sediment and Bioaccumulation Monitoring
  - Sediment Analyses
  - Bioaccumulation Analyses

During 2008, the program consisted of sampling the influent, effluent, and sludge twice for toxic pollutants and pesticides and one receiving water quality sampling. In addition, the Municipality of Anchorage conducted the required self-monitoring program for the influent, effluent, and sludge. The sediment and bioaccumulation components of the program were conducted during 2003 and 2004 and were required to be performed only once by the NPDES permit.

This annual report provides information and data pertaining to the monitoring program performed to meet the requirements as set forth in the NPDES permit that became effective on 2 August 2000. The report covers the period of 1 January through 31 December 2008.



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## **SUMMARY**

### **PURPOSE**

This report is submitted to meet the requirements of the U.S. Environmental Protection Agency (EPA) and the Alaska Department of Environmental Conservation (ADEC) as outlined in the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 that was signed on 30 June 2000 and became effective on 2 August 2000. This permit authorizes discharge of effluent from the John M. Asplund Water Pollution Control Facility (Asplund WPCF). Wastewater from the Municipality of Anchorage (MOA) is treated at this facility before discharge to the receiving waters of Knik Arm in Cook Inlet, Alaska. The NPDES permit incorporates the requirements necessitated by a 301(h) waiver from secondary treatment and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA, 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

### **HISTORY**

In September 1979, the MOA submitted to the EPA a 301(h) secondary treatment waiver application proposing an improved discharge which eliminated chlorination and required the addition of both a 610-meter (m) extension and a 305-m diffuser to the Asplund WPCF outfall. The outfall extension was intended to move the point of discharge beyond the influence of a gyre that was reported to exist off Point Woronzof on a flood tide which was presumed to carry effluent toward shore, causing bacterial contamination of the shoreline.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. The central issue was to evaluate outfall design alternatives and the chlorination/no chlorination option in relation to a system of eddies that occur on the flood tide. These studies were completed as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended plan recommended the use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same water quality standards could be met by chlorinating and installing an improved diffuser at the end of the existing outfall, there was no need to extend the outfall.

Concurrent with the studies to amend the facilities plan, a revised 301(h) waiver application was submitted to the EPA. After extensive EPA review, public comment, and hearings, the Final Permit Decision was issued and the five-year NPDES permit became effective 16 October 1985 (EPA, 1985a). As required by this permit, a multi-port diffuser was installed in August 1987 prior to the second year of receiving water sampling. Fourteen years of monitoring were performed under the initial NPDES permit.

The MOA submitted an application to renew the 301(h) waiver from secondary treatment in 1990. A more recent application was submitted in 1998 with additional information provided to EPA in 1999. A draft NPDES permit that incorporated the 301(h) waiver was issued in 1999 for public comment. The renewed permit was signed by EPA on 30 June 2000 to become effective on 2 August 2000 for five years. The permit was administratively extended in August 2005 pending a permit renewal decision from EPA. The most recent application for a reauthorization of the NPDES permit and 301(h) waiver was submitted in January 2005 and is currently being reviewed by EPA.

## **RECEIVING WATER ENVIRONMENT**

The Asplund WPCF discharges into the Knik Arm of Cook Inlet, a unique body of estuarine water with extremely high tidal fluctuations (over 39 feet [12 meters] with a mean range of 7.98 meters [m] at Anchorage; NOAA/NOS, 2008). These fluctuations produce extensive tidal flats, swift tidal currents of 4 - 6 knots, and intense mixing within Cook Inlet. The continual input of sediments, combined with the re-suspension of bottom sediments due to high bottom shear stress with each tidal cycle, result in naturally high suspended sediment concentrations of up to 2500 milligrams/liter (mg/L) in Knik Arm. This sediment originates from riverine and glacial melt waters discharging into Cook Inlet and Knik Arm from the Knik, Matanuska, and Susitna Rivers.

Large temperature extremes occur between summer and winter. In the winter, ice can reach thicknesses of 1 - 2 m and consists of broken pieces due to the large tides and currents. Other important factors to this study are the large volume of saline water that enters Cook Inlet that is completely vertically mixed with the riverine inputs by tidal turbulence which allows this water body to be very effective in wastewater dilution and assimilation.

## **MONITORING OBJECTIVES**

The monitoring that was conducted during 2008 consisted of two main components: (1) in-plant monitoring of influent, effluent, and sludge, including whole effluent toxicity testing; and (2) receiving water quality monitoring in the vicinity of the discharge and at a control site across Knik Arm. Objectives of the 2008 program are summarized as follows:

### **2008 MONITORING OBJECTIVES**

#### **Influent, Effluent, and Sludge Monitoring**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- help monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the CWA
- provide data for evaluation of permit re-issuance

#### **Water Quality**

- determine compliance with the NPDES permit and State of Alaska water quality criteria
- aid in assessing the water quality at the discharge point
- determine compliance with the regulatory criteria of Section 301(h) of the CWA
- determine the level of bacterial contamination in nearshore waters
- provide data for evaluation of permit re-issuance

## **MONITORING RESULTS**

As part of its self-monitoring program, the Anchorage Water and Wastewater Utility (AWWU) conducted daily, weekly, and monthly sampling of influent, effluent, and sludge, depending on the parameter measured. In addition, monitoring for toxic pollutants and pesticides was

conducted twice during 2008, once in June and once in August. Whole effluent toxicity testing was conducted quarterly, while receiving water quality monitoring was performed once in June. The following summarizes results of this year's monitoring based on the permit requirements:

## **2008 MONITORING RESULTS**

### **Influent, Effluent, and Sludge**

- The influent, effluent, and sludge monitoring showed, that with no exceptions, the Asplund WPCF met the NPDES permit requirements and complied with State of Alaska water quality standards (AWQS). MOA's self-monitoring of total residual chlorine (TRC), pH, fecal coliform, 5-day biological oxygen demand (BOD<sub>5</sub>), and total suspended solids (TSS) showed compliance with all permit effluent limitations in 2008.
- MOA's self-monitoring of TRC and pH showed that the permit limit for daily maximum TRC levels in the effluent was never exceeded and pH was within permit limits in 2008.
- The permit limit of a monthly maximum geometric mean of 850 fecal coliform by most probable number technique per 100 milliliters (FC MPN/100 mL) was not exceeded in 2008. The fecal coliform monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL was also met for every month in 2008.
- MOA's self-monitoring of TSS and BOD<sub>5</sub> showed compliance with both regulatory and permit effluent limitations. TSS and BOD<sub>5</sub> were well within the daily, weekly, and monthly criteria for the entire year. Average monthly removals for BOD<sub>5</sub> and TSS of greater than 30 percent (%) are required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). The removal rate for both TSS and BOD<sub>5</sub> met the 30 % minimum removal requirement for all months during 2008. Annual removals were 77 % for TSS and 39 % for BOD<sub>5</sub> which indicate excellent plant performance.
- Total aromatic hydrocarbons (TAH), total aqueous hydrocarbons (TAqH), and total ammonia concentrations in the effluent were all found to be below their maximum allowable effluent concentrations (MAECs) in 2008.
- Cyanide and metals concentrations in the effluent never exceeded their MAECs at any time during any of the 2008 sampling events.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were all within the established range or lower than values from a national study of secondary treatment plants (EPA 1982a).
- Toxic pollutant sludge concentrations were found to be very low compared to the limits established under 40 CFR Part 503 and all were either not-detected or within the established range or lower than values from a national study of secondary treatment plants, with most metals falling at or below the typical concentrations and all metals well below 95<sup>th</sup> percentile worst case values (EPA 1985c).
- Whole effluent toxicity testing conducted quarterly met all permit limitations for toxicity for all species and all sampling events in 2008.

## Water Quality

- Little variation among stations was observed for most hydrographic parameters indicating that the receiving water environment is uniform and well mixed near the outfall.
- To test the hypothesis that the water quality at the zone of initial dilution (ZID) boundary was not degraded with respect to the water quality at the nearfield and control sites, statistical comparisons were employed. Conventional parameters such as salinity, temperature, TSS, and pH did show statistically significant differences between sites, however, these were not ascribed to the outfall but rather to the slightly different water mass properties across Knik Arm at the control sites. No significant differences were seen for dissolved oxygen, turbidity, color, fecal coliform, or TRC.
- Fecal coliform concentrations in receiving water and intertidal samples were found to be very low at all stations. AWQS criteria of a median of not more than 14 FC MPN/100 mL, a geometric mean of not more than 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that dissolved metals were all below the site-specific AWQS. None of the dissolved metals exceeded the AWQS at the diffuser or control locations and no significant differences between the outfall and control sites were seen for dissolved metals. Total recoverable metals were elevated compared to the dissolved as a result of the high suspended sediment load. Statistically significant differences were seen between the outfall and control sites for most total recoverable metals due to the naturally higher TSS and metals concentrations at the control site and were not ascribed to the outfall.
- All cyanide concentrations in the receiving waters (outfall and control locations) were found to be below the receiving water quality criterion limit of 1.0 µg/L and no statistically significant differences were detected between concentrations at the control and outfall stations.
- Supplemental receiving water samples also demonstrated that TAH and TAqH met the AWQS at all locations. No statistically significant differences were detected between the control and outfall sites for either TAH or TAqH.
- Turbidity met the AWQS criteria at all stations. TRC was at or below 100 µg/L at all locations, as compared to the AWQS of 7.5 µg/L for chronic and 13.0 µg/L for acute marine water use. Due to seawater matrix interferences, the lowest level detection for TRC that was achievable in 2008 is higher than the AWQS, therefore it could not be determined if this standard was met at all sites. Color was found to meet the AWQS of not exceeding natural conditions for all samples and was always <5 color units.

## CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the NPDES permit. The Asplund WPCF is operating within regulatory requirements with no exceptions seen in 2008 and is showing no measurable impacts to the marine environment.



## **1.0 INTRODUCTION**

### **1.1 REGULATORY/ENVIRONMENTAL BACKGROUND**

The monitoring program is designed to meet the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit AK-002255-1 which authorizes discharge of municipal effluent into the Knik Arm of Cook Inlet receiving waters from the John M. Asplund Water Pollution Control Facility (Asplund WPCF), operated by the Municipality of Anchorage (MOA; Figure 1). The NPDES permit, which became effective on 2 August 2000, incorporates the requirements necessitated by a 301(h) secondary treatment waiver and is in compliance with provisions of the Federal Water Pollution Control Act as amended by the Clean Water Act (CWA 33 U.S.C. §1251 et seq.) and the Water Quality Act of 1987, P.L. 100-4.

#### **1.1.1 Regulatory Background**

In 1972, while the Asplund WPCF and outfall were being built for the MOA, the Federal Water Pollution Control Act (FWPCA) was amended to establish two phases of effluent limitations applicable to all Publicly Owned Treatment Works (POTWs). Under 301(b), POTWs were required to achieve secondary treatment of effluent by 1 July 1977 and the "best practicable waste treatment technology" by July 1983.

Congress again amended the FWPCA in 1977. Section 301(h) was added, providing that the Administrator of the EPA, upon application from a POTW and with the concurrence of the State, might issue an NPDES permit waiving the requirements of Section 301(b). On 15 June 1979, EPA promulgated the regulations regarding the issuance of this waiver of secondary treatment to an applicant discharging into certain ocean and estuarine waters and demonstrating compliance with the 301(h) criteria.

In September 1979, the MOA submitted to the EPA a 301(h) waiver application proposing an improved discharge which eliminated chlorination and required the addition of both an extension and diffuser to the Asplund WPCF outfall. Earlier studies had recommended the construction of a 610-m outfall extension and a 305-m diffuser. The proposed extension/diffuser reportedly could meet fecal coliform receiving water standards without chlorination and prevent shore contact of the wastewater plume.

As a parallel program, the MOA undertook preparation of a wastewater master plan for the Anchorage area. The resultant Wastewater Facilities Plan for Anchorage, (Ott Water Engineers, Inc. et al., 1982) and the Environmental Impact Statement, City of Anchorage, Alaska, Wastewater Facilities (EPA and Jones & Stokes, 1982) were accepted by the EPA and ADEC.

Further studies were subsequently undertaken to derive design criteria for the outfall improvements. Significant efforts were included in this study to improve the reconnaissance level data upon which the outfall length and diffuser design were to be based and to evaluate bacterial standards applicable to Knik Arm. The central issue was to evaluate outfall design alternatives and the chlorination or no-chlorination option in relation to the presence of a system of eddies that occur to the east of Point Woronzof on the flood tide which might be capable of transporting the effluent shoreward. These latter studies were completed as an Amendment to the Wastewater Facilities Plan for Anchorage, Alaska (CH2M Hill et al., 1985). This amended

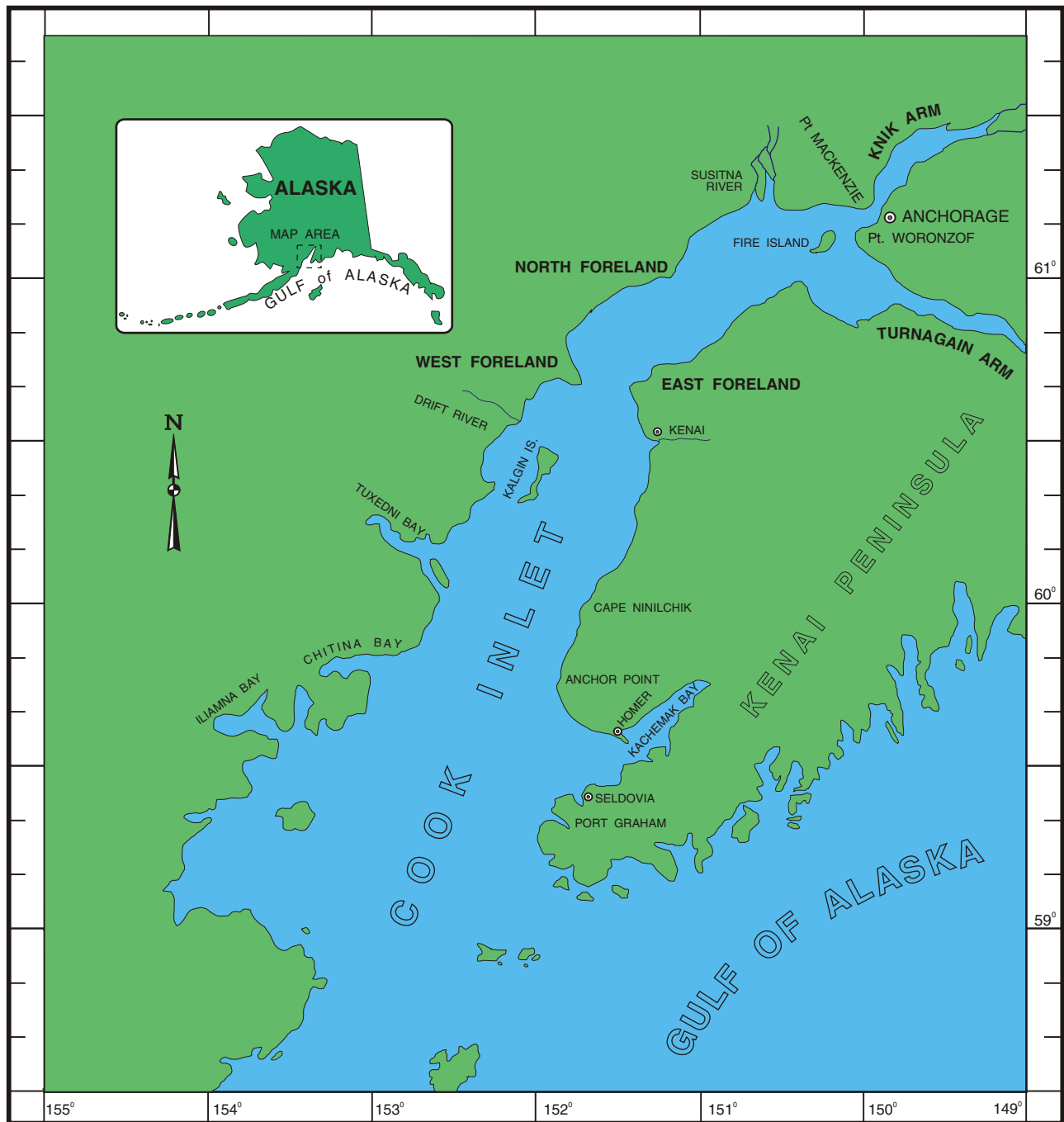


Figure 1. General Study Area.

plan recommended use of the existing 245-m outfall with the addition of a three-nozzle diffuser. It was shown that chlorination would be required to meet bacterial standards even with an extended outfall and diffuser. Because the same standards could be met by use of chlorination and the existing outfall, there was no need to extend the outfall. With continued chlorination, all water quality standards were predicted to be met by the amended plan.

Concurrent with the studies to amend the facilities plan, a revised application entitled Application for Modification of Secondary Treatment Requirements, Section 301(h), Clean Water Act was submitted to the EPA (CH2M Hill et al., 1984). The EPA Region 10 301(h) Review Team's Tentative Decision Document, entitled Analysis of the Section 301(h), Secondary Treatment Variance Application for the Asplund WPCF (EPA, 1985b), and a draft NPDES permit were made available for public comment on 17 January 1985. After comments and appropriate hearings, the Final Permit Decision (EPA, 1985a) was issued 13 September 1985, and the start date of the five-year NPDES Permit AK-002255-1 was listed as 16 October 1985. As required by this permit, a multi-port diffuser was installed at the Asplund WPCF outfall in the beginning of August 1987. This occurred prior to the 1987 summer water quality monitoring program. This original NPDES permit expired on 15 October 1990.

The MOA submitted a renewal application for the permit in April 1990 which addressed amendments made to the 301(h) provisions by the Water Quality Act. That renewal application was not acted upon and the facility continued to operate under an administrative extension of the 1985 permit until August 2000. In 1998 it was projected that the growth of Anchorage would result in the discharge limits contained in the 1985 permit being exceeded within a few years. Therefore, the MOA prepared and submitted another renewal application which replaced the 1990 application in October 1998 (CH2M Hill, 1998).

In tandem with the renewal application, the MOA conducted special studies and submitted a request for site-specific water quality criteria (SSWQC) to the ADEC for the Point Woronzof area of Cook Inlet in December 1998. This request for SSWQC was for turbidity and a suite of metals and was necessitated because the Alaska Water Quality Standards (AWQS) for marine waters could not be achieved for these waters as a result of the naturally high suspended sediment loads in Cook Inlet due to glacial inputs. The approach to the request was based on the EPA's Metals Policy that had been recently promulgated which recommends the use of only the dissolved fraction of metals as bioavailable and appropriate for the protection of aquatic life and associated beneficial uses of the water body. Following both agency and public review and comments, the SSWQC were incorporated into the AWQS as amended on 27 May 1999. The SSWQC for the Point Woronzof area included turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Following the promulgation of these new AWQS, a tentative decision to grant the MOA its 301(h) variance was made by EPA on 4 November 1999. The tentative decision, draft NPDES permit, and fact sheet were then made available for public review and comments. The State of Alaska's Division of Government Coordination issued its Final Consistency Determination for the action in February 2000. The current NPDES permit for the Asplund WPCF was signed by EPA and went into effect 2 August 2000 for five years, and was then administratively extended in August 2005 pending permit renewal. The most recent application for a reauthorization of the NPDES permit and 301(h) waiver was submitted in January 2005 and is currently under review by the EPA.

The NPDES permit specified the required monitoring program. The Monitoring Program Plan (Kinnetic Laboratories, Inc., 2000a), submitted to the EPA in October 2000, identified how the MOA plans to fulfill the requirements of this monitoring program. This annual report documents the progress and results of the monitoring program that were performed in 2008.

Since the issuance of the current permit, EPA has approved ADEC's proposed use of dissolved metals for the State's marine water quality criteria, approved all of the proposed SSWQC for Upper Cook Inlet in the vicinity of Pt. Woronzof, and removed Alaska from the National Toxic Rule (EPA, 2006). Except for cadmium, where the dissolved standard changed from 9.3 µg/L to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC.

### **1.1.2 Environmental Background**

The Asplund WPCF discharges to the receiving waters of Cook Inlet, Alaska. The discharge is located off Point Woronzof in Knik Arm of Upper Cook Inlet.

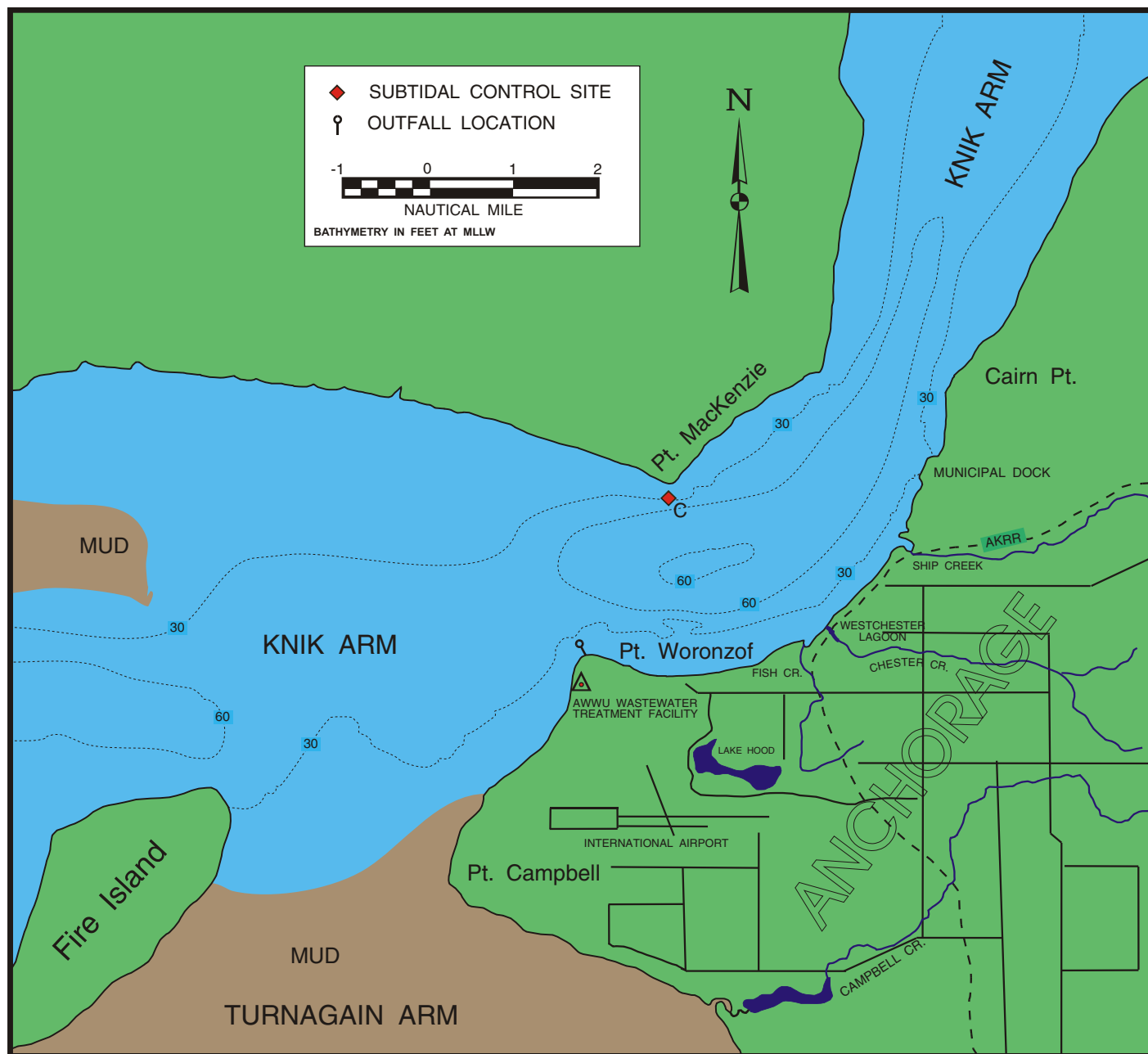
Cook Inlet is a major tidal estuary that is approximately 333 kilometers (km; 180 nautical miles) long and 93 - 148 km (50 - 80 nautical miles) wide at its lower end. Bathymetry indicates the Inlet is deep, generally 36.6 m (20 fathoms) north of the Forelands and about 164.6 m (90 fathoms) at the mouth. Numerous rivers, including the major Susitna River drainage, discharge into the Inlet. A detailed map of the Point Woronzof region indicates deep water (9.1 - 51.8 m) extending well past Anchorage up the Knik Arm (Figure 2).

Cook Inlet is a unique estuary, with perhaps the closest parallel being the Bay of Fundy between New Brunswick and Nova Scotia, Canada. The occurrence of tidal bores at the head, currents of 4 - 6 knots, suspended loads of up to 2500 mg/L, large temperature extremes, and moving pancake ice of up to one meter (m) thick make Cook Inlet unique. The high tidal ranges result from the geometry of the Inlet which has a natural resonance period close to the semi-diurnal tidal period. The resulting large tidal fluctuations and fast currents cause complete vertical mixing of the Inlet waters.

Other important factors to this study are the large volume of saline water that enters Cook Inlet that is completely vertically mixed with the riverine inputs by tidal turbulence which allows this water body to be very effective in wastewater dilution and assimilation.

The particle size distributions of the natural suspended sediments off Point Woronzof show that very large particles are suspended by the current-generated turbulence, with 50 percent (%) of the load being in the size range of 65 - 250 microns. The settling of large particles is seen in the Inlet at slack tide. Settling rate tests of the suspended material show that 93% of the solids in the ambient water sample settle in twenty minutes.

Previous work has indicated that due to the extremely swift currents, no seabed accumulation of suspended sediments, either natural or from the discharge, occur in the vicinity of the outfall. In this location, the bottom is strictly coarse gravel and cobble because of these currents. However, areas of deposition do exist, such as to the east of Point Woronzof, where mudflats and beaches are found, and to the southwest of the Point. The area between Fire Island and the mainland is hard-packed sand with no deposition of silt or finer materials as a result of the high current energy. Silt sedimentation is a difficult problem at the Port of Anchorage where the Corps of Engineers conduct annual dredging operations. Of course, any suspended solids in these



**Figure 2. Asplund WPCF Outfall and Control Station Locations.**

materials of effluent origin would actually dilute the much larger natural load in the receiving water (400 - 2,500 mg/L versus approximately 50 mg/L effluent). Studies have also shown that essentially no benthic biota are found on the scoured cobble/gravel bottom or on the rock beaches at Point Woronzof and the control area. Similar sampling of soft bottom beaches and tidal flats showed very sparse abundances and very low diversities. Benthic and intertidal marine fauna populations are limited by the harsh physical environment of mud and silt, high turbulence and bottom scouring, large tide and currents, and ice conditions.

Current trajectories in the immediate vicinity of the outfall are of concern because of flow separation zones on either side of Point Woronzof. Previous work has indicated that, on a flood tide, a clockwise system of eddies exist east of Point Woronzof. These eddies may result in the shoreward transport of wastes at certain stages of tide. A flow separation also exists to the west of Point Woronzof during ebb flow; however the effluent is not entrained shoreward in this area.

## **1.2 STUDY DESIGN**

### **1.2.1 Monitoring Objectives**

The monitoring program as described by NPDES Permit No. AK-002255-1 includes plant influent/effluent sampling; sewage sludge management procedures; water quality monitoring; biological and toxicological monitoring; and a toxics control program. The objectives of the overall monitoring program are to:

- determine compliance with the NPDES permit
- determine compliance with State of Alaska water quality criteria
- determine effectiveness of the industrial pretreatment program
- aid in assessing the water quality at the discharge point
- characterize toxic substances
- monitor plant performance
- determine compliance with the regulatory criteria of Section 301(h) of the Clean Water Act (CWA)
- determine the level of bacterial concentrations in nearshore waters
- monitor for changes in sediment quality (organic enrichment, alteration of grain size distribution, and pollutant contamination)
- determine if pollutants from the discharge are accumulating in exposed biological organisms
- provide data for evaluation of permit re-issuance

### **1.2.2 Program Description**

The elements of the monitoring program for the Asplund WPCF are:

- Influent, Effluent, and Sludge Monitoring, including
  - In-Plant Sampling
  - Toxic Pollutants and Pesticides (including Metals and Cyanide)
  - Pretreatment Monitoring
  - Whole Effluent Toxicity (WET) Testing
- Receiving Water Quality Monitoring, including

- Plume Dispersion
- Intertidal Bacteria
- Biological and Sediment Monitoring, including
  - Sediment Quality
  - Bioaccumulation

Table 1 provides an overview of the monitoring requirements as described by the permit. Detailed information regarding each program component is provided in Section 2.0, Methods.

### 1.2.3 Hypotheses

The null (no effect) hypotheses tested for this year of monitoring are as follows:

*H<sub>o1</sub>: Applicable State and Federal effluent and receiving water standards were met by the Asplund WPCF discharge.*

*H<sub>o2</sub>: Water quality at the boundary of the ZID was not significantly changed with respect to nearfield or control stations.*

## 1.3 CONTRACTOR

The MOA's designated contractor for the 2008 Asplund WPCF Monitoring Program was Kinnetic Laboratories, Inc. (KLI) of Anchorage, Alaska.

For influent, effluent, and sludge monitoring, aromatic hydrocarbon, pesticide, and volatile and semi-volatile priority pollutant analyses (gas chromatography/mass spectrometry scans) were performed by TestAmerica Laboratories, Inc. (TestAmerica) of Arvada, Colorado. Trace metals (total and dissolved) for the toxic pollutant, pesticide, and pretreatment monitoring, normally performed by the Municipality's Asplund WPCF Laboratory were also performed by TestAmerica of Arvada, Colorado. WET testing was performed by ToxScan, Inc. of Watsonville, California. Asbestos analyses were performed by Solar Environmental Services, Inc. of Anchorage, Alaska, and EMSL Analytical of Westmont, New Jersey. In addition, the Municipality's Asplund WPCF Laboratory performed the monthly in-plant analyses as part of its self-monitoring program and contracted the Part 503 sludge analyses to SGS Environmental Services, Inc. of Anchorage, Alaska.

Analytica Alaska Inc. of Anchorage, under subcontract to KLI, provided analytical and field support for the receiving water sampling for total residual chlorine (TRC) and color. Analytical support for the receiving water sampling included: Battelle (Sequim, Washington) for trace metals; Soil Control Lab (Watsonville, California) for total suspended solids (TSS) and cyanide; TestAmerica for aromatic hydrocarbons; Spectra Laboratories in (Tacoma, Washington) for bacteriology; and Texas A&M University's Geochemical and Environmental Research Group (GERG) (Texas) for polycyclic aromatic hydrocarbons (PAHs) analyses.

## 1.4 PERIOD OF REPORT

This report documents the progress and results of the monitoring program from 1 January through 31 December 2008 under the current NPDES permit.

**Table 1. Overall Monitoring Requirements.**

Parameter	Frequency	Sample Type	Remarks
In-Plant Sampling	See Table 2	See Table 2	See Table 2 - includes flow, TRC, DO, BOD <sub>5</sub> , TSS, temperature, pH, fecal coliform, total ammonia as nitrogen, enterococci bacteria, and oil and grease
Toxic Pollutants and Pesticides (including Metals and Cyanide)	2/year <sup>a</sup>	influent, 24-hr composite effluent, 24-hr composite sludge, 24-hr composite	See Table 2
Pretreatment Program	2/year <sup>a,b</sup>	influent, three 24-hr composite effluent, three 24-hr composite sludge, 24-hr composite (8 grabs/day)	Includes metals and cyanide plus percent solids for sludge
Whole Effluent Toxicity (WET) Testing	4/year <sup>c</sup>	effluent, 24-hr composite	See Table 2
Receiving Water Quality	1/year <sup>d</sup>	receiving water	See Table 5
Intertidal Bacteria	1/year <sup>e</sup>	intertidal receiving water	Fecal coliform sampling at 8 intertidal stations
Sediment	Once during the fourth year of the permit <sup>e</sup>	grab samples of surficial (0-2 cm) sediment collected at intertidal and subtidal stations <sup>f</sup>	Includes total volatile solids (TVS), toxic pollutants and pesticides (including metals and cyanide), and sediment grain size distribution
Bioaccumulation	Once during the fourth year of the permit	grab samples of intertidal macroalgae ( <i>Vaucheria</i> spp.)  Note: Macroalgae was not available during 2003 or 2004. Therefore, in consultation with EPA and AWWU pacific cod ( <i>Gasdus macrocephalus</i> ) were collected and analyzed for this permit component in October 2004 <sup>g</sup>	Includes toxic pollutants and pesticides (including metals and cyanide)

<sup>a</sup> Sampling will be conducted twice per year: once in summer dry conditions and once in summer wet conditions.

<sup>b</sup> The first day of three consecutive days of sampling will be part of the Toxic Pollutant and Pesticides (metals and cyanide) sampling performed twice each year.

<sup>c</sup> WET testing will be performed on a quarterly basis.

<sup>d</sup> Sampling will be conducted once per year in summer dry conditions.

<sup>e</sup> Sampling will be conducted in conjunction with the receiving water sampling.

<sup>f</sup> Sampling will be performed at Intertidal Stations 1, 2, and Control (IT-1, IT-2, and IT-C); a subtidal station located at the ZID boundary, and a subtidal control station near Point MacKenzie (in a similar water depth as the ZID boundary).

<sup>g</sup> Sampling was to be performed in conjunction with the sediment analyses however algae was not available in sufficient quantities for sampling in 2003 or 2004. Pacific cod were collected and analyzed for this permit component in October 2004.



## 2.0 METHODS

### 2.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING

Influent, effluent, and sludge monitoring is outlined in Table 2. Routine daily, weekly, and monthly sampling of conventional pollutant parameters and flow rate were performed by AWWU. The less-frequently monitored parameters of enterococci bacteria, oil and grease, toxic pollutants and pesticides (including metals and cyanide), and Whole Effluent Toxicity (WET) testing were handled by KLI.

- ✓ determine compliance with the NPDES permit and State of Alaska water quality criteria
- ✓ determine effectiveness of the industrial pretreatment program
- ✓ aid in assessing the water quality at the discharge point
- ✓ characterize toxic substances
- ✓ help monitor plant performance
- ✓ determine compliance with the regulatory criteria of Section 301(h) of the CWA
- ✓ provide data for evaluating re-issuance of this permit

#### 2.1.1 In-Plant Monitoring

In-plant influent, effluent, and sludge sampling was performed by AWWU personnel as described in Table 2 and in a separate monitoring program plan prepared by AWWU (AWWU, 2000). Samples were obtained following the schedule of frequency required by the permit. Influent was sampled at a representative location in the influent headworks, upstream from the recycle streams. Effluent was sampled at a well-mixed point downstream from the chlorination input point in the final effluent line. Composite sludge samples were obtained from the belt filter press. Grab samples were obtained for total residual chlorine (TRC), dissolved oxygen (DO), temperature, pH, and fecal coliform. Composite samples were obtained for analysis of biochemical oxygen demand (BOD<sub>5</sub>), total suspended solids (TSS), and total ammonia as nitrogen.

#### 2.1.2 Toxic Pollutant and Pesticide Monitoring

As outlined in the permit, toxic pollutant and pesticide sampling was conducted twice this year, once during June 2008 (summer dry) and once during August 2008 (summer wet). Samples were collected as required by the permit and either analyzed by AWWU personnel or provided to KLI for shipment to the appropriate analytical laboratory. Plant influent was sampled as discrete grabs or by flow-proportional composite samplers (depending on the analysis method) at a representative location in the influent headworks upstream from the recycle streams. Effluent was sampled as discrete grabs or using flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Influent and effluent samples were chilled as required during composite sampling. Composite sludge samples were obtained from the belt filter press.

Samples were composited for the analysis of pesticides, semi-volatile organics, metals, asbestos, and cyanide. Samples consisted of composites of flow-proportioned samples collected over a 24-hour (hr) period using two ISCO Model 3700 Refrigerated Autosamplers. Grab samples for volatile organics analysis were collected every three hours during the 24-hr sampling period and designated for compositing during analysis at the laboratory. Grab samples were collected for

**Table 2. Influent, Effluent, and Sludge Monitoring Requirements.**

Parameter	Sample Point <sup>a</sup>	Sample Frequency	Sample Type
Flow <sup>b</sup>	effluent	continuous	continuous
Total Residual Chlorine (TRC) <sup>b</sup>	effluent	continuous <u>or</u> every 2-4 hrs	grab
Dissolved Oxygen (DO) <sup>b</sup>	effluent	4/week	grab
Biochemical Oxygen Demand (BOD <sub>5</sub> ) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Total Suspended Solids (TSS) <sup>b</sup>	influent and effluent	4/week	24-hr composite
Temperature <sup>b</sup>	influent and effluent	4/week	grab
pH <sup>b</sup>	influent and effluent	4/week	grab
Fecal Coliform Bacteria <sup>b</sup>	effluent	3/week	grab
Total Ammonia as N <sup>b</sup>	effluent	1/month	24-hr composite
Enterococci Bacteria <sup>c</sup>	effluent	2/year <sup>d</sup>	grab
Oil and Grease <sup>c</sup>	effluent	2/year <sup>d</sup>	grab
Toxic Pollutants and Pesticides (including Metals and Cyanide) <sup>e</sup>	influent, effluent, and sludge	2/year <sup>d</sup>	24-hr composite
WET <sup>f</sup>	effluent	4/year <sup>f</sup>	24-hr composite

<sup>a</sup> When both influent and effluent samples are required, samples will be collected during the same 24-hr period.

<sup>b</sup> AWWU will perform this monitoring component.

<sup>c</sup> KLI will perform this monitoring component.

<sup>d</sup> Twice per year sampling: once during summer in dry conditions and once in wet conditions.

<sup>e</sup> As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, molybdenum, nickel, silver, and zinc in influent, effluent, and sludge will be sampled, along with percent solids (in sludge only). In 2008, these metals were analyzed and reported by TestAmerica as total recoverable metals and dissolved metals for influent and effluent and as total metals in mg/kg dry weight for sludge. Sampling will be as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Mon - Fri), the first day of which coincides with the twice yearly sampling (summer-dry and-wet conditions); sludge as one composite of eight grabs/day when influent and effluent samples are being taken. In addition, the other four metals from the toxic pollutant list will be analyzed in the summer wet/summer dry samples: beryllium, antimony, thallium, and selenium (by TestAmerica).

<sup>f</sup> WET requirements are summarized in the text (Section 2.1.4). Initial testing will be a screening period performed during three quarters, during which three species will be tested to determine the most sensitive species. Re-screening will be performed each year during one quarter (different than the previous year) to determine the species to use for continued testing. Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units, TUC=100/NOEC).

analysis of total hydrocarbons as oil and grease and purgeable aromatic compounds. Sludge samples were collected from the conveyor belt every three hours over a 24-hr period and the eight samples composited.

At time of collection, all samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

Toxic pollutants as defined by the permit are those substances listed in 40 Code of Federal Regulations (CFR) 401.15 (Table 3). This list involves 65 categories of pollutants, including asbestos, aromatic hydrocarbons, pesticides, metals, and polychlorinated biphenyls (PCBs). Pesticides as defined in the permit are demeton, guthion, malathion, mirex, methoxychlor, and parathion as listed in 40 CFR 125.58. Other pesticides which were tested are included on the toxic pollutants list (40 CFR 401.15). The methods that were used to analyze these constituents for this program and for which KLI will be responsible, as well as those performed by AWWU, are also provided in Table 3. Preservation and maximum holding time information for each of these methods is provided in Table 4. All samples were collected in the appropriate precleaned sample containers and preserved, if necessary, as described by the EPA method. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.1.3 Pretreatment Monitoring**

The pretreatment program as outlined in Table 1 and Table 2 was performed by the AWWU. This monitoring was performed twice in 2008 in conjunction with the summer dry and wet sampling. As part of the pretreatment program sampling requirements, arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc in influent, effluent, and sludge were sampled, along with percent solids (in sludge only). These metals are normally analyzed and reported by AWWU, however due to Plant construction activities in 2007 and 2008, they were analyzed by TestAmerica as total recoverable metals and dissolved metals for influent and effluent and as total recoverable metals in dry weight for sludge. Sampling was conducted as follows: Influent and effluent as three separate 24-hr composite samples taken on 3 consecutive days (Monday - Friday), the first day of which coincided with the twice-yearly sampling (summer dry and summer wet, respectively); sludge as one composite of eight grabs/day when influent and effluent samples were being taken. A detailed study plan describing this monitoring was provided previously (AWWU, 2000).

### **2.1.4 Whole Effluent Toxicity Testing**

As outlined in the permit, the WET testing must be performed on a quarterly basis on 24-hr composite effluent samples. Effluent was sampled by discrete flow-proportional samplers at a well-mixed point downstream from the chlorination input point in the final effluent line. Effluent samples were collected in the appropriate precleaned sample containers as described by the method, chilled, and shipped immediately to the toxicity laboratory for testing. Samples were appropriately labeled at the time of collection using pre-prepared, project-specific sample labels as described in Section 2.5. Sample collection and shipment were documented using project-specific chain of custody forms. Sample containers were immediately placed on gel ice after sampling and remained chilled during shipment to the analytical laboratory.

**Table 3. Methods<sup>a</sup> for the Analysis of Toxic Pollutants and Pesticides for Influent, Effluent, and Sludge Monitoring.**

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Pesticides and PCBs	Inorganic Compounds
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Benzene Chlorinated benzenes Dichlorobenzenes Ethylbenzene Toluene Xylenes <sup>b</sup>	<b>EPA 625 (Inf/Eff)</b> <b>SW 8270C (Sludge)</b> Acenaphthene Benzidine Chloralkyl ethers Chlorinated ethanes Chlorinated naphthalenes Chlorinated phenols 2-chlorophenol DDT & metabolites Dichlorobenzenes Dichlorobenzidine 2,4-dichlorophenol 2,4-dimethylphenol Dinitrotoluene Diphenylhydrazine Fluoranthene Haloethers Heptachlor & metabolites Hexachlorobutadiene Hexachlorocyclopentadiene Hexachloroethane Isophorone Naphthalene Nitrobenzene Nitrophenols Nitrosamines Polycyclic aromatic hydrocarbons (PAHs) Pentachlorophenol Phenol Phthalate esters	<b>EPA 614 (Inf/Eff)</b> <b>SW 8141A (Sludge)</b> Demeton Malathion Parathion Guthion <sup>b</sup>	<b>EPA 100.1/EPA 100.2 (Inf/Eff)</b> <b>Polarized Light Microscopy (PLM; Sludge)</b> Asbestos
<b>EPA 624 (Inf/Eff)</b> <b>SW 8260B (Sludge)</b> Acrolein <sup>b</sup> Acrylonitrile <sup>b</sup> Benzene Carbon tetrachloride Chloralkyl ethers Chloroform Chlorinated benzenes Chlorinated ethanes 1,2-dichloroethane Dichloroethylenes Dichloropropane Dichloropropene 1,1,1-trichloroethane Ethylbenzene Halomethanes Methylene chloride Bromoform Dichlorobromomethane Toluene Tetrachloroethylene Trichloroethylene Vinyl chloride	<b>EPA 608 (Inf/Eff)</b> <b>SW 8081A Pesticides and SW 8082 PCBs (Sludge)</b> Aldrin/Dieldrin Chlordane (technical Mixture & metabolites) DDT & metabolites Endosulfan & metabolites Endrin & metabolites Heptachlor metabolites Hexachlorocyclohexane Polychlorinated biphenyls (PCBs) Toxaphene Mirex <sup>b</sup> Methoxychlor <sup>b</sup>	<b>EPA 200.8 (Inf/Eff)</b> <b>SW 6020 (Sludge)</b> Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Molybdenum Nickel Silver Selenium Thallium Zinc  <b>EPA 245.1 (Inf/Eff)</b> <b>SW7471A (Sludge)</b> Mercury  <b>SM 4500-CN-E (Inf/Eff)</b> <b>EPA 9010B Mod (Sludge)</b> Cyanide	
	<b>SW 8280A (Inf/Eff/Sludge)</b> 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)		

Inf Influent

Eff Effluent

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> Included with expanded method analyte list.

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**

<b>Parameter</b>	<b>Sample Type</b>	<b>Preservation</b>	<b>Maximum Holding Time</b>	<b>Method<sup>a</sup></b>
Temperature	Inf/Eff	None required	Analyze immediately	SM 2550B
pH	Inf/Eff	None required	Analyze immediately	SM 4500-H <sup>+</sup> B
BOD <sub>5</sub>	Inf/Eff	Cool, 4 °C	48 hours	SM 5210B
Total Residual Chlorine	Eff	Fill completely	Analyze immediately	Hach 8167
DO Electrode	Eff	None required	Analyze immediately	SM 4500-O G
Suspended solids	Inf/Eff	Cool, 4 °C	7 days	EPA 160.2
Total solids	Sludge	Cool, 4 °C	7 days	SM 2540G
Enterococci	Inf/Eff	Cool, 4 °C, Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> in effluent	24 hours	SM 9230C
Asbestos	Inf/Eff	Cool, 4 °C, dark	Filter within 48 hours of receipt at lab	EPA 100.1/100.2
	Sludge	Cool, 4 °C	28 days	Polarized Light Microscopy (PLM)
Fecal Coliform Bacteria	Eff	Cool, 4 °C 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	6 hours	SM 9221E
Total Ammonia as N	Eff	Cool, 4 °C, H <sub>2</sub> SO <sub>4</sub> to pH <2	28 days	Hach 8038
Total Hydrocarbons as Oil and Grease	Inf/Eff	Cool, 4 °C, dark HCl to pH<2	28 days	EPA 1664 HEM <sup>b</sup>
Volatile Organics	Inf/Eff	Cool, 4 °C, dark, HCL to pH<2 L- Ascorbic Acid in effluent	14 days	EPA 624
	Sludge	Cool, 4 °C	14 days	SW 8260B
Dioxins	Inf/Eff	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
	Sludge	Cool, 4 °C	30 days until extraction/45 days after extraction	SW 8280A
Semi-Volatile Organics	Inf/Eff	Cool, 4 °C, dark L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 625
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8270C
Pesticides & PCBs	Inf/Eff	Cool, 4 °C, L- Ascorbic Acid in effluent	7 days until extraction/40 days after extraction	EPA 614 and EPA 608
	Sludge	Cool, 4 °C	14 days until extraction/40 days after extraction	SW 8141A/8081A SW 8082

**Table 4. Preservation and Analytical Procedures for Influent, Effluent, and Sludge.**  
(continued)

Parameter	Sample Type	Preservation	Maximum Holding Time	Method <sup>a</sup>
Cyanide (total)	Inf/Eff	Cool, 4°C, NaOH to pH>12, 0.6 g L- Ascorbic acid (in effluent)	14 days	SM 4500 CN,E Mod
	Sludge	Cool, 4°C	14 days	EPA 9010B Mod
Arsenic	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Beryllium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Cadmium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Chromium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Copper	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Lead	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Mercury	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	28 days	EPA 245.1
	Sludge	Cool, 4°C	28 days	SW 7471A
Nickel	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Selenium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Silver	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Zinc	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Antimony	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH<2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020
Thallium	Inf/Eff	Cool, 4°C, HNO <sub>3</sub> to pH <2	6 months	EPA 200.8
	Sludge	Cool, 4°C	6 months	EPA 6020

<sup>a</sup> Unless otherwise noted, "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020 or 40 CFR 136; "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th Ed., 1998. "SW" refers to the EPA Manual SW 846, *Test Methods for Evaluating Solid Waste*. 3rd Ed., 1986.

<sup>b</sup> EPA, 1999a. Document No. EPA-821-R-98-002.

Inf Influent  
Eff Effluent

Initial WET testing was performed as a screening period over the course of three quarters during each of which three toxicity tests were performed; each with one vertebrate and two invertebrate species. These screening tests were performed during the third and fourth quarters of 2000 and the first quarter of 2001. Screening included the vertebrate *Atherinops affinis* (topsmelt) for survival and growth; an invertebrate bivalve species (either *Mytilus* spp. [mussel; survival and growth] or *Crassostrea gigas* [oyster; larval development]; and an invertebrate echinoderm species fertilization test (*Strongylocentrotus purpuratus* [purple urchin] or *Dendraster excentricus* [sand dollar]). Once the screening period was completed, the single most sensitive species (bivalve) was used for subsequent toxicity testing until re-screening was performed. As required by the permit, re-screening must be performed each year during one quarter (different than the previous year) to determine the most sensitive species to use for continued testing. Re-screening was performed in the second quarter of 2002 and the third quarter of 2003, with bivalves again found to be the most sensitive species. Re-screening that was performed during 2004, 2005, 2006, 2007, and again in the fourth quarter of 2008 found the purple sea urchin to be the most sensitive species.

Accelerated testing requirements will be triggered if chronic toxicity is greater than 143 TUC (chronic toxicity units,  $TUC = 100 / \text{No Observed Effect Concentration [NOEC]}$ ). Accelerated testing will include the implementation of the initial investigation Toxicity Reduction Evaluation (TRE) workplan along with at least one additional toxicity test. If the investigation indicates the source of toxicity (e.g., a plant upset), and no toxicity greater than 143 TUC is observed in this test, the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed, then accelerated testing will continue with six more tests performed on a biweekly basis over a 12-week period. Testing will commence within two weeks of receipt of the sample results of the exceedance. If no toxicity greater than 143 TUC is observed in these tests, then the normal schedule of testing will be re-instated. If toxicity greater than 143 TUC is observed in any of the six tests, then a TRE will be initiated within 15 days of receipt of the sample results of the exceedance. A Toxicity Identification Evaluation (TIE) may also be initiated as part of the overall TRE process, and if this is initiated during the accelerated testing period, the accelerated testing schedule may be terminated or used as necessary in performing the TIE.

Toxicity testing was performed as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms (EPA, 1988) and the 'West Coast Marine Methods Manual', First Edition (EPA, 1995) as required by the permit. The presence of chronic toxicity was estimated as described by these references. Quality assurance for the toxicity testing included the testing of a series of five dilutions and a control, including the concentration of the effluent at the edge of the ZID (0.70 %) as well as two dilutions above and two dilutions below 0.70 %. Reference toxicants were tested concurrently with the effluent testing, using the same procedures. If the effluent tests did not meet all the acceptability criteria as specified in the referenced methods, then the effluent was re-sampled and re-tested as soon as possible. Control and dilution water was natural or synthetic seawater as called for by the referenced methods. If the dilution water was different from the culture water, a second control using culture water will be run. Dilution water met test acceptability criteria.

As part of the WET testing, an initial investigation TRE plan was prepared and submitted to EPA under separate cover (Kinnetic Laboratories, Inc., 2000b). This plan describes the events that will occur should chronic toxicity be detected. As required by the permit and the manual Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants (EPA, 1999b), a preliminary TRE will be initiated within 15 days of the receipt of sample results of the

permit exceedance. A more detailed TRE workplan will subsequently be developed to more fully investigate and identify the cause of the toxicity, identify and provide a schedule of the actions that AWWU will use to mitigate the impact of the discharge, and to prevent the recurrence of the toxicity. As noted above, the TIE may be initiated as part of the overall TRE process during the accelerated testing schedule.

### 2.1.5 Part 503 Sludge Monitoring

Operations at the Asplund WPCF include a sludge incinerator that is subject to regulation under 40 CFR Part 503 - Standards for the Use or Disposal of Sewage Sludge. The current permit requires sludge monitoring twice per year, once during the dry conditions in summer and once during wet conditions as noted above. There are no Part 503 monitoring requirements included in the reissued permit because EPA Region 10's current policy is to remove these requirements from NPDES permits with the intention of writing "sludge only" permits in the future. However, the Part 503 regulations are "self-implementing" in that the facility is required to meet the monitoring requirements in the regulation whether they are specifically included in a permit or not. Therefore, monitoring at the Asplund WPCF includes Part 503 monitoring of sludge. Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Frequency required for mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to also test for mercury and beryllium once per 60 days, more frequently than required, so as to be consistent with the testing frequency for the other metals. Allowable limits are site-specific and were re-calculated per Part 503 regulation in May 2008 by CH2M Hill based on 2007 data (CH2M Hill, 2008). While methods for this monitoring component have been described elsewhere (AWWU, 2000) and results of the monitoring have been provided under separate reporting requirements to EPA, the data are also included in this report.

## 2.2 RECEIVING WATER QUALITY MONITORING

### 2.2.1 Water Quality Sampling

As required by the permit, water quality must be monitored annually during the summer in dry weather conditions (Table 1). Sampling was performed at non-fixed stations made during consecutive ebb and flood tides at the outfall station and a single flood tide at the control station. Station locations were determined by following the track of drogues released above the diffuser at the outfall station and at the control station located north across Knik Arm from Point Woronzof, directly off Point MacKenzie in a similar water depth as the outfall. Three drogue tracks on each tide were performed at each location. Four stations were sampled on each drogue track:

- |  |
|--|
| <ul style="list-style-type: none"> <li>✓ determine compliance with the NPDES permit and State of Alaska water quality criteria</li> <li>✓ aid in assessing the water quality at the discharge point</li> <li>✓ determine compliance with the regulatory criteria of Section 301(h) for the CWA</li> <li>✓ determine the level of bacterial contamination in nearshore waters</li> <li>✓ provide data for evaluation of permit re-issuance</li> </ul> |
|--|

- above the diffuser
- as close to the ZID boundary as practicable
- at least one station in the channel of Knik Arm
- in the shallow subtidal area before the drogue grounds.



As noted in the permit, the ZID is defined as the water column above the area delineated by the sector of a circle with the center located over the outfall, 30 meters (m) shoreward of the diffuser, 650 m in radius, and with a 220° angle (Figure 3).

The plume location was followed by using a holey-sock drogue (Figure 4). The drogue consisted of a six-foot cylindrical nylon tube ballasted at the bottom with a two-pound weight and attached at the top with a bridle to a spherical float. This float was attached to the tracking spar via a connecting line. These cylindrical or spherical designs that enclose a parcel of water have been found to more accurately follow the ambient current patterns than other drogue designs such as the window shade design (Sombardier and Niiler, 1994).

Sampling was performed by positioning the vessel over the diffuser (or control station) for the first sampling station of the drogue track. The drogue was released at approximately the same time and followed until navigation information indicated that the ZID had been reached, at approximately 650 m from the outfall, at which time the ZID boundary station was sampled. The third and fourth stations along each drogue track were sampled as the drogue traveled through the channel in Knik Arm or as it slowed in shallow water prior to grounding. Navigation was accomplished using a differential global positioning system (DGPS). If DGPS coordinates were unavailable, a standard GPS receiver was used to obtain navigational information.

Samples were collected for the parameters outlined in Table 5. The surface waters of all stations were sampled for fecal coliform, color, turbidity, and TRC. Surface samples were collected by grabbing directly into the appropriate sample bottles at sample depth (15 - 30 centimeters [cm]). Mid- and bottom depth turbidity samples were collected at all stations using Niskin<sup>®</sup> bottles. Mid- and bottom depths were determined at each station using the survey vessel's fathometer. Samples were collected as simultaneously as possible at all three target depths. Hydrographic profiles of temperature, salinity, DO, and pH were collected at all stations using a Seabird SEACAT<sup>®</sup> CTD (conductivity, temperature, and depth) recorder. This instrument was also equipped with a DO, pH, and optical backscatter (turbidity) sensors to allow profiles of these parameters to be recorded. Samples for the analysis of total and dissolved metals, TSS, hydrocarbons (PAH), and total volatile aromatic hydrocarbons (TAH) were collected from surface waters at the first three stations (diffuser, ZID boundary, and channel) along the first flood drogue track at both the outfall and control stations. These samples were collected directly into the appropriate sample containers. A single replicate sample for each parameter or a single profile was collected at each station except for quality control samples, which are described in Section 4.2.

Samples were analyzed following the methods provided in Table 6. Samples were appropriately labeled at time of collection using pre-prepared, project-specific sample labels as described in Section 2.5 and prepared for shipment to the laboratory. Preservation and maximum holding time information for each of these methods is also provided in Table 6. All sample containers were immediately placed on gel ice after sampling. Samples remained chilled as required during shipment to the analytical laboratory.

### **2.2.2 Intertidal Bacterial Sampling**

As part of the water quality monitoring effort, intertidal sampling for fecal coliform bacteria was also performed at eight intertidal stations provided in Table 7 and depicted in Figure 3. Two

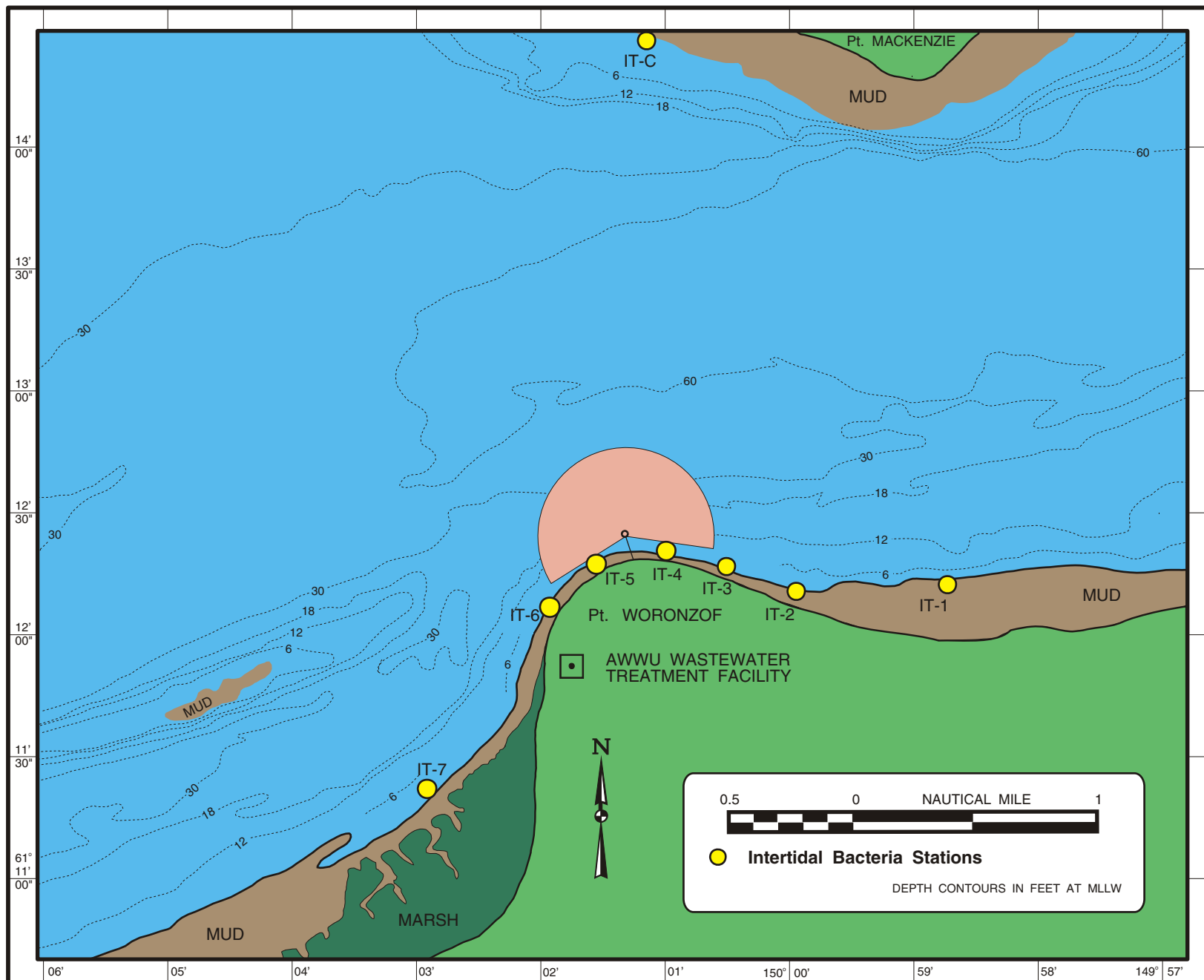
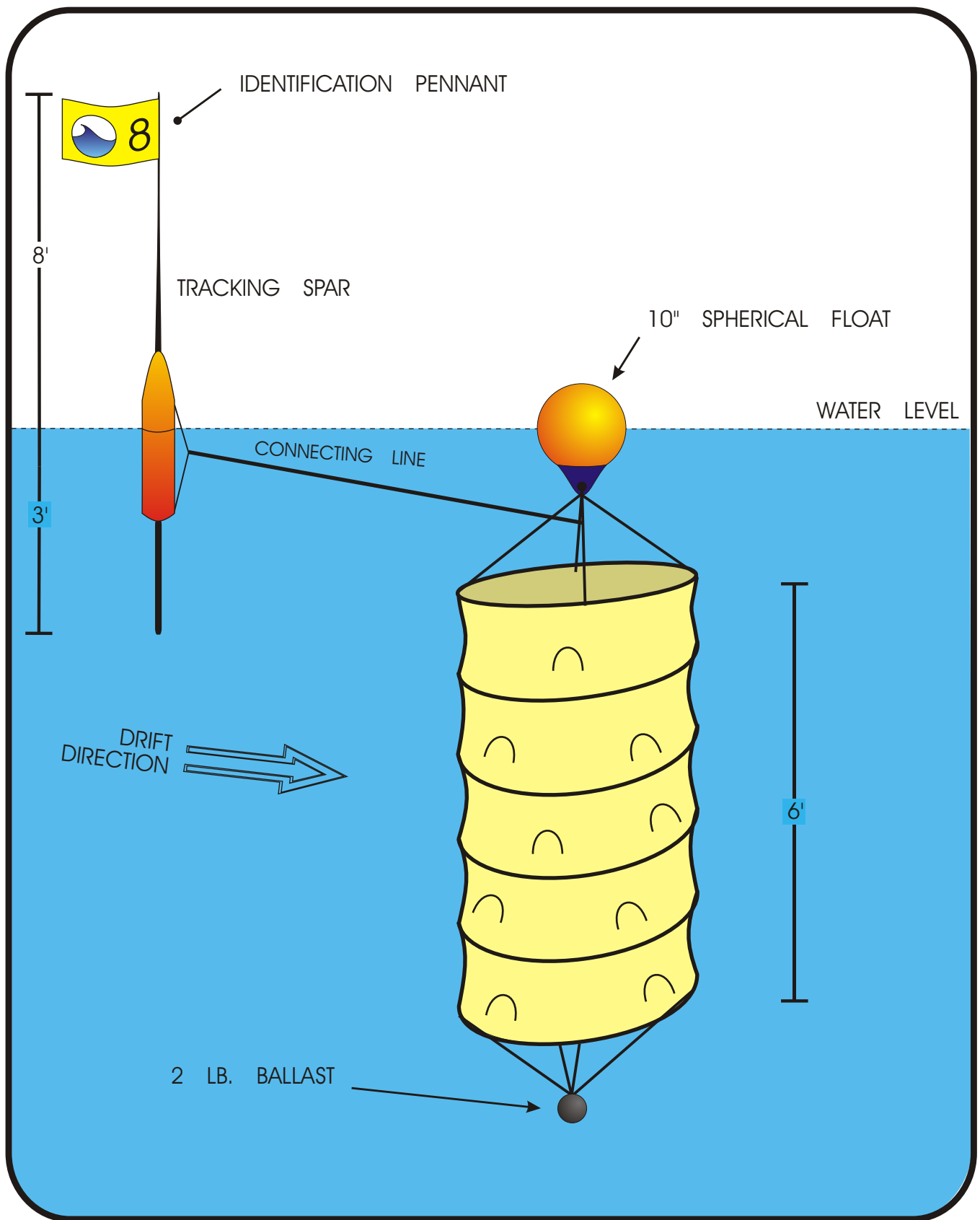


Figure 3. Asplund WPCF Outfall, ZID, and Locations of Intertidal Bacteriological Sampling.



**Figure 4. Holey-Sock Drogue, Flotation, and Marker Buoy.**

**Table 5. Receiving Water Quality Monitoring Requirements.**

Parameter	Sampling Depth		
	Surface (above 0.5 m)	Surface, Mid-, and Bottom	Profile (1- to 3-m intervals)
Fecal Coliform	all stations <sup>a</sup> , within the 15-30 cm layer		
Color	all stations, within the 15-30 cm layer		
Total Residual Chlorine (TRC)			
Field Observations: presence or absence of floating solids, visible foam (other than trace), oil wastes, and/or sheen	all stations where surface samples are collected		
Total Aqueous Hydrocarbons (TAqH)	first three stations along the first flood drogue track at both the outfall and control locations		
Total Aromatic Hydrocarbons (TAH)			
Metals and Cyanide <sup>b</sup>			
Total Suspended Solids (TSS)			
Turbidity		all stations	
pH			all stations
Temperature			
Dissolved Oxygen (DO)			
Salinity			

<sup>a</sup> Non-fixed stations were sampled following the track of drogues released at the diffuser (outfall station) or at a fixed station having the same depth due north across Knik Arm from Point Woronzof near Point MacKenzie (control station). Three drogue tracks were made during each of a consecutive flood and ebb tide at the outfall station. Stations included the following along each outfall drogue track: above the diffuser; as close to the ZID boundary as possible; one near-field station in the channel of Knik Arm; and a far-field station along the drogue path or in the shallow subtidal area before the drogue grounds. Three drogue tracks were also made during a flood tide at the control station in conjunction with or as soon as practicable as the sampling at the outfall station.

<sup>b</sup> Metals include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc; these were analyzed and reported as both total recoverable and dissolved metals.

**Table 6. Methods, Preservation, and Maximum Holding Times for the Analysis of Receiving Water Quality Samples.**

Parameter	Method <sup>a</sup>	Preservation	Maximum Holding Time
Fecal Coliform	SM 9221E	Cool, 4°C, dark	24 hours
Color	SM 2120B	Cool, 4°C, dark	48 hours
Total Residual Chlorine (TRC)	SM 4500-Cl D	None	Analyze immediately
Turbidity	SM 2130B	Cool, 4°C, dark	24 hours
Total Aqueous Hydrocarbons (TAqH)	EPA 602 plus xylenes	Cool, 4°C, HCl to pH<2, L- Ascorbic Acid in presence of chlorine	14 days
	EPA 610	Cool, 4°C, dark, L- Ascorbic Acid in presence of chlorine	7 days until extraction/ 40 days after extraction
Total Aromatic Hydrocarbons (TAH)	EPA 602	Cool, 4°C, HCl to pH<2 L- Ascorbic Acid in presence of chlorine	14 days
Metals (Total Recoverable and Dissolved)	See note <sup>b</sup>	Cool, 4°C, HNO <sub>3</sub> to pH <2 (after filtration for dissolved)	90 days – Hg 180 days – all others
Cyanide	EPA 335.2	NaOH, 4°C	14 days
Total Suspended Solids (TSS)	EPA 160.2	Cool, 4°C	7 days
Dissolved Oxygen (DO)	SM 4500-O G (electrode)	None	<i>in situ</i>
pH	SM 4500-H <sup>+</sup> B	None	<i>in situ</i>
Temperature	SM 2550B <sup>c</sup>	None	<i>in situ</i>
Salinity	SM 2520B <sup>c</sup>	None	<i>in situ</i>

<sup>a</sup> "EPA" refers to the EPA document *Methods for Chemical Analysis of Water and Wastes*, revised March 1983, Document No. EPA-600/4-79-020, or 40 CFR 136. "SM" refers to *Standard Methods for the Examination of Water and Wastewater*, 20th ed., 1998.

<sup>b</sup> Dissolved metals were filtered before acidification; total recoverable metals were digested by ASTM Method D4309-91. Cadmium, chromium, copper, nickel, lead, silver and zinc were subject to pre-concentration by chelation following EPA Method 1640 prior to analysis by inductively coupled plasma mass spectroscopy. These metals, along with antimony, beryllium, selenium, and thallium, were analyzed as total recoverable and dissolved metals as appropriate for ICP/MS (EPA Method 1638). Mercury was analyzed using cold vapor atomic fluorescence following EPA Method 1631. Arsenic was determined by flame ionization atomic spectroscopy (SW846 Method 7062).

<sup>c</sup> Modified for *in situ* measurements collected with the CTD.

**Table 7. Approximate Locations of Intertidal Bacteria Sampling Stations.**

Station	Station Location Relative to Diffuser	Latitude (N)	Longitude (W)
IT-1	2000 m east	61° 12' 10"	149° 58' 55"
IT-2	1200 m east	61° 12' 11"	149° 59' 50"
IT-3	750 m east	61° 12' 15"	150° 00' 20"
IT-4	250 m east	61° 12' 19"	150° 00' 52"
IT-5	250 m southwest	61° 12' 15"	150° 01' 10"
IT-6	750 m southwest	61° 12' 02"	150° 01' 28"
IT-7	2000 m southwest	61° 11' 22"	150° 02' 02"
IT-C	Across Knik Arm from the diffuser	61° 14' 26"	150° 01' 09"

replicate water samples were collected from each station at slack high water when the water depths were between 1 to 3 feet (ft). Additional quality control samples were collected as described in Section 4.2. Samples were collected by grabbing from 15 - 30 cm depths directly into the appropriate container. Samples were analyzed using the same procedures described above and in Table 6.

In addition to the required intertidal samples, two replicated fecal coliform samples were also collected once during the water quality monitoring effort from three area streams that empty into Knik Arm: Ship, Chester, and Fish Creeks. Samples were analyzed using the same procedures described previously and in Table 6.

At time of collection, all fecal coliform samples were appropriately labeled using pre-prepared, project-specific sample labels as described in Section 2.5. All samples were collected in the appropriate precleaned sample containers, dechlorinated, and preserved, if necessary, as described by the method. Samples were placed on gel ice immediately after sampling and remained chilled during transport to the laboratory. Field notes, including navigational and sampling information, were recorded on project-specific field logs. As required by the permit, field observations taken at each station included the presence or absence of floating solids, visible foam in other than trace amounts, oily wastes, or sheen. Weather observations were also recorded. All field documentation was reviewed by the field leader at the completion of the survey. Sample collection and shipment was documented using project-specific chain of custody forms as described in Section 2.5.

### **2.2.3 Vessel Support**

The *NORTH FORTY*, a 26-ft KLI-owned survey vessel, was used for drogue tracking and water sampling in 2008. In addition, a 15-ft Zodiac<sup>®</sup> was used to retrieve grounded drogues and conduct intertidal bacteria sampling. The Zodiac<sup>®</sup> was also used to transport samples with short holding times (i.e., bacterial samples) ashore.

## **2.3 SEDIMENT AND BIOACCUMULATION MONITORING**

As stipulated in the NPDES permit, sediment and bioaccumulation monitoring was to be performed during the fourth year after the effective date of the permit. Intertidal and subtidal sediment sampling was performed in conjunction with the 2003 receiving water monitoring sampling. Bioaccumulation sampling was performed during 2004.

## **2.4 LABORATORY ANALYSIS**

Laboratory analyses of all samples for this program followed preservation and analysis procedures described by EPA-accepted protocols as referenced in this document (Table 4 and Table 6). These procedures are fully described by the referenced documents and/or 40 CFR 136.

## **2.5 DOCUMENTATION PROCEDURES**

All field and sampling data were recorded on appropriate pre-printed project-specific field data forms. Field data forms included drogue tracking forms, water sampling log forms, sample identification/chain of custody forms, and sample labels. These forms were tailored to the monitoring program to facilitate accurate and complete documentation of field activities. The field task leader was responsible for review and approval of all field documentation; this was completed as soon as possible after sampling.

Sampling logs included specific information such as station identification, sample identification numbers, navigational data, sampling or photographic observations, sampling depths, and collection date and time. Names of personnel performing the sampling were recorded on each log. Drogue tracking logs included station identification information along with navigational data to allow the track of each drogue to be later determined and plotted. Pre-printed labels included such information as station designation, analysis type, date of collection, sampling personnel, and a pre-assigned sample identification number to uniquely identify each sample. Quality control samples were labeled as were regular environmental samples so as to be blind to the laboratory analysts.

Sample identification and integrity was ensured by a rigidly-enforced chain of custody program. Sample identification/chain of custody (COC) forms provided specific information concerning the identification, handling, and shipment of samples.

Pertinent information from the sample label was transferred onto the COC, along with other information as required. COC forms were completed, signed by field personnel, and copied if needed. In some cases, where photocopying was not convenient or possible, two-part carbonless forms were used. The original of each COC form was packed with the samples in coolers for shipment to the laboratory. The field task leader retained a copy of each form for the field records and for tracking purposes should a shipment become lost or delayed. Upon receipt of the samples at the analytical laboratory, the laboratory sample custodian signed the samples in by checking all sample labels against the COC information and noting any discrepancies as well as sample condition (e.g., containers leaking or damaged during shipment). Internal sample tracking procedures at the laboratory were initiated immediately upon receipt of samples as described by each laboratory's standard operating procedures.





### **3.0 RESULTS**

#### **3.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

##### **3.1.1 Monthly Discharge Monitoring Data**

Results of AWWU's daily, weekly, and monthly sampling of influent and effluent for non-metals are presented as monthly summaries in Table 8. Averages are based on the 12-month period from January through December 2008.

Removal of BOD<sub>5</sub> averaged 39 %, and removal of TSS averaged 77 % for the 12-month reporting period. These averages exceed the minimum values required by the amendments to the CWA (40 CFR Part 125.60; Final Rule, 8/9/94), whereby dischargers with 301(h) waivers are required to remove 30 % of BOD<sub>5</sub> and 30 % of the suspended solids. On a monthly average basis, the removal of BOD<sub>5</sub> ranged from 31 to 44 % removal with no values violating the limit in 2008. The highest monthly average effluent BOD<sub>5</sub> was 149 mg/L, substantially less than the permit limitation of 240 mg/L. All of the BOD<sub>5</sub> values (daily, weekly, and monthly averages) reported for the calendar year 2008 met the permit limitations. Total suspended solids concentrations in the effluent were low and typical of those seen historically at the Asplund WPCF with the highest monthly average effluent concentration of 56 mg/L compared to the permit limit of 170 mg/L. The yearly average effluent TSS was 51 mg/L. Weekly average and daily maximum TSS also met permit requirements.

The highest mean monthly fecal coliform bacteria count was 63 FC MPN/100 mL seen in August 2008. All of the months in 2008 met the permit limitation of 850 FC MPN/100 mL based on a geometric mean of at least five samples, which ranged from 6 to 63 FC MPN/100 mL, well below the permit limitation. The criterion of not more than 10 % of the samples analyzed should exceed 2,600 FC MPN/100 mL was met for every month in 2008. In the past, this criteria has typically been exceeded for at least one month during the year.

The TRC daily maximum concentration did not exceed the permit-required limitation of 1.2 mg/L for the entire year, with a maximum daily value of 0.90 mg/L and a monthly maximum range of 0.47 to 0.90 mg/L. The monthly averages of TRC concentrations ranged from 0.20 to 0.49 mg/L, with an overall average of 0.35 mg/L. The permit requirement that effluent pH remain between 6.5 and 8.5 standard units was always met, exhibiting a minimum and maximum range of 6.6 to 7.7 pH units for the year.

Although other parameters such as DO, temperature, and ammonia do not have permit limitations, ranges were typical of those seen historically. DO in the effluent exhibited monthly averages ranging from 2.2 to 3.8 mg/L, with a yearly average of 2.9 mg/L which was slightly lower than that seen in 2007 where the yearly average was 3.7 mg/L. Temperature showed yearly averages of 12.0 and 11.9 °C in the influent and effluent, respectively. Monthly values for total ammonia in effluent ranged from 16.1 to 22.5 mg/L, with a yearly average of 19.9 mg/L, similar to that seen historically. Average Plant flow for the year was 29.2 mgd which is very similar to the average flow rate seen over the past five years.

**Table 8. Discharge Monitoring Data for Influent and Effluent Non-Metals.**

Month	Average EFF Flow Rate (MGD)	Temperature Average (°C)		pH Minimum/ Maximum (pH) <sup>a</sup>		TRC Average (mg/L)		DO Average (mg/L)		BOD <sub>5</sub> Average (mg/L)			Total Susp. Solids Average (mg/L)			Fecal Coliform Average (MPN/100 mL)		Total Ammonia Average (mg/L)	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	REM (%)	INF	EFF	REM (%)	INF	EFF	INF	EFF
01/08	27.3	10.9	9.7	7.1/7.6	6.9/7.5	NT	0.20	NT	2.2	189	131	31	194	52	73	NT	13	NT	18.7
02/08	28.3	10.8	9.4	7.3/7.7	7.0/7.3	NT	0.40	NT	3.5	200	131	35	202	50	75	NT	7	NT	16.8
03/08	29.5	11.0	9.3	6.9/7.7	7.0/7.4	NT	0.46	NT	2.6	198	120	39	218	49	78	NT	16	NT	20.8
04/08	30.5	11.0	9.6	7.2/7.7	7.0/7.4	NT	0.49	NT	3.5	196	121	38	211	51	76	NT	7	NT	16.1
05/08	31.1	11.8	10.7	7.0/7.7	6.9/7.5	NT	0.35	NT	3.8	203	123	40	218	54	75	NT	27	NT	19.7
06/08	29.2	12.6	13.1	6.9/8.2	6.7/7.2	NT	0.36	NT	2.2	210	132	37	239	55	77	NT	6	NT	22.0
07/08	29.8	13.9	14.6	7.0/8.5	6.7/7.3	NT	0.33	NT	2.3	244	147	40	252	53	79	NT	7	NT	19.9
08/08	29.5	14.2	15.1	7.0/8.0	6.6/7.2	NT	0.30	NT	2.9	228	149	35	265	56	79	NT	63	NT	22.5
09/08	30.5	13.9	14.9	6.9/7.8	6.7/7.3	NT	0.32	NT	2.4	202	149	40	232	50	78	NT	14	NT	21.3
10/08	29.0	12.6	13.3	7.0/7.7	6.8/7.4	NT	0.34	NT	2.5	229	127	44	228	47	80	NT	25	NT	21.5
11/08	27.9	10.7	11.7	7.1/7.8	6.9/7.7	NT	0.34	NT	3.2	215	121	44	213	47	78	NT	22	NT	20.0
12/08	27.6	10.0	10.9	6.8/7.6	6.7/7.3	NT	0.31	NT	3.2	213	119	44	205	46	78	NT	27	NT	20.1
<b>Average</b>	29.2	12.0	11.9	6.8/8.5	6.6/7.7	---	0.35	---	2.9	211	131	39	223	51	77	---	20	---	19.9

<sup>a</sup> Monthly or Yearly (minimum-maximum)

NT Not tested (tested in effluent only)

REM Percent Removal

--- Not applicable

### 3.1.2 Toxic Pollutants and Pesticides Analyses

Toxic pollutant and pesticide monitoring for influent, effluent, and sludge was conducted on 17 - 18 June 2008 for summer-dry weather and 13 - 14 August 2008 for the summer-wet sampling. Sampling was performed over a 24-hr period by AWWU personnel.

Results of the toxic pollutant and pesticide analyses are provided in Table 9 (June 2008) and Table 10 (August 2008). For semi-volatile organic compounds (EPA Methods 625/8270C), volatile organic compounds (EPA Methods 624/8260B), and pesticides (EPA Methods 608/8081A/8082 and 614/8141A), only those pollutants that were detected in the influent, effluent, or sludge are listed. Refer to Appendices A and B for the laboratory reports and a complete listing of pollutants analyzed. A number of the constituents were found only in the sludge. Pollutants found in the influent were often detected in the effluent, and vice versa. In general, pollutant concentrations were very low and many of the concentrations reported for the two samplings were below method detection limits (MDLs) or method reporting limits (MRLs).

Percent removal rates shown in these tables were computed from influent and effluent concentration values. Percent removal was only calculated for compounds where a concentration in the influent and/or effluent was reported at a level above the MDL or MRL. Compounds with estimated concentrations (denoted with a "J" qualifier) were not used for percent removal calculation unless a non-estimated concentration was reported for that compound in the other type of sample (influent or effluent). The reported MDL or MRL was used for calculations where necessary (where a compound was reported as non-detect [ND]). Where several laboratory duplicate analyses were performed for a parameter, a percent removal is provided for each duplicate. For summed values, such as the TAH defined as benzene, ethylbenzene, toluene, and xylenes (BETX), the MRL was used for values reported as ND.

Some of the pollutant removal rates were actually negative values due to the higher concentrations found in the effluent or where a compound was detected in the effluent but not the influent. Both positive and negative removals can be caused by effluent samples being more homogenous due to mixing in the clarifiers, whereas detecting a point-source pollutant in the influent is often more variable. Also, there is a residence time for the effluent in the plant, along with the addition of approximately 1 mgd of well and city water in the treatment process, as well as the addition of Eagle River and Girdwood WWTFs' sludge after the Asplund headworks, therefore the influent does not correspond directly with the effluent.

The types and concentrations of measured organic compounds varied between the two sampling periods. Compounds that were detected in both the influent and effluent during at least one of the sampling events included: bis (2-ethylhexyl) phthalate, chloroform, diethyl phthalate, 1,4-dichlorobenzene, ethylbenzene, methylene chloride, phenol, tetrachloroethene, toluene, and total xylenes. Many of these compounds were estimated values that were below their reporting limits and therefore were qualified with a J. Methylene chloride was seen in the blank in both June and August and bis (2-ethylhexyl) phthalate was seen in the blank in June. These compounds are common laboratory contaminants and have been noted in the past; these data were appropriately qualified with a B indicating potential laboratory contamination. Although not detected in the method blanks, diethyl phthalate is another common laboratory contaminant that was seen in the influent and effluent during both June and August. Organic compounds that were seen in the influent, effluent, and sludge during the June 2008 sampling, included estimated concentrations

**Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 17 and 18 June 2008.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILE ORGANICS– detected substances only</b>				
Benzene	ND (5.0)	ND (5.0)	ND (1.7)	---
Chloroform	2.3 J	3.0 J	ND (1.7)	---
Ethylbenzene	1.6 J	0.76 J	ND (1.7)	---
Methylene Chloride	5.3 B	3.4 J,B	ND (1.7)	36
Toluene	11	6.8	0.98 J	38
Xylenes (total)	9.1 J	4.5 J	ND (1.7)	---
1,4- Dichlorobenzene	ND (5.0)	ND (5.0)	0.53 J,B	---
Tetrachloroethene	1.8 J	0.94 J	0.19 J	---
<b>SEMI-VOLATILE ORGANICS – detected substances only</b>				
Bis (2-ethylhexyl) phthalate	37 J,B	33 J,B	20	---
Diethyl phthalate	7.7 J	7.7 J	ND (22)	---
Phenol	33 J	23 J	ND (11)	---
Phenanthrene	ND (100)	ND (100)	0.79 J	---
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	44000	28000	NT	36
Total Aromatic Hydrocarbons as BETX from EPA Method 624	26.7	17.1	6.1	36

**Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 17 and 18 June 2008. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a,b</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	0.20 J	0.39 J	NT	---
Arsenic	ND (5.0)	ND (5.0)	NT	---
Beryllium	ND (1.0)	ND (1.0)	NT	---
Cadmium	ND (1.0)	ND (1.0)	NT	---
Chromium	1.2 J	1.1 J	NT	---
Copper	6.5	14	NT	-115
Lead	0.29 J	0.78 J	NT	---
Mercury	ND (0.20)	ND (0.20)	NT	---
Molybdenum	1.6 J	6.4	NT	-300
Nickel	2.2	2.7	NT	-23
Selenium	ND (5.0)	ND (5.0)	NT	---
Silver	0.21 J	0.51 J	NT	---
Thallium	0.04 J	ND (1.0)	NT	---
Zinc	7.0 J	20	NT	-186
<b>TOTAL METALS</b>				
Antimony	1.1 J	0.57 J	1.2	---
Arsenic	3.2 J	2.5 J	4.7	---
Beryllium	ND (1.0)	ND (1.0)	0.080 J	---
Cadmium	0.67 J	0.51 J	1.4	---
Chromium	8.0 B	2.3 B, J	24 B	---
Copper	92	36	210 B	61
Lead	13	2.8	19	78
Mercury	0.14 J	0.047 J	0.9	---
Molybdenum	9.8 B	6.4 B	4.6	---
Nickel	6.5	2.5	11	62
Selenium	1.3 J	1.3 J	2.5	---
Silver	3.2	1.3	6.0	59
Thallium	ND (1.0)	ND (1.0)	0.024 J	---
Zinc	290	120	550 B	59

**Table 9. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 17 and 18 June 2008. (continued)**

Pollutant	Influent <sup>a,b</sup> (µg/L)	Effluent <sup>a,b</sup> (µg/L)	Sludge <sup>a,b</sup> (µg/g)	Percent Removal
<b>PESTICIDES – detected substances only</b>				
Malathion	1.0 J / 1.0 J	ND (1.2)	ND (0.51)	---/---
Methoxychlor	ND (2.5)/ ND (2.5)	ND (2.5)	0.027 J, COL	---/---
<b>ENTEROCOCCI BACTERIA</b>				
Enterococci <sup>c</sup>	NT	[8 /13] / [2 / <2]	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>d</sup>	ND (100.00)	ND (100.00)	ND	---
Cyanide <sup>b</sup>	2.5 J	9.0 J / (0.19J/0.25J) <sup>e</sup>	0.71 J	---
Dioxin (2,3,7,8-TCDD)	ND (0.00016)	ND (0.00013)	ND (0.00023)	---

- a* Detection limits or reporting limits are included in parentheses for non-detected (ND) values
- b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)
- c* Enterococci reported in MPN/100 ml; two replicates- (sample and duplicate).
- d* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)
- e* Duplicate analyses for CN collected during receiving water sampling, analyzed by Soil Control Lab Inc.
- COL More than 40% RPD between primary and confirmation column results. The lower of the two results is reported.
- J Estimated value (below MRL but above MDL)
- B Method blank contamination, associated method blank contains the target analyte at a reportable level.
- Not applicable (not calculated)
- ND None detected
- NT Not tested

**Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 13 and 14 August 2008.**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>VOLATILE ORGANICS– detected substances only</b>				
Benzene	ND (5.0)	ND (5.0)	ND (0.069)	---
Chloroform	2.2 J	3.0 J	ND (0.14)	---
1, 2-Dichlorobenzene	ND (5.0)	ND (5.0)	0.014 J,B	---
1, 4-Dichlorobenzene	0.92 J	0.96 J	0.063 J	---
Ethylbenzene	ND (5.0)	ND (5.0)	0.021 J	---
Methylene chloride	6.1 B	7.7 B	0.021 J,B	-26
Tetrachloroethene	0.92 J	ND (5.0)	0.041 J	---
Toluene	4.5 J	6.4	0.49	-42
Xylenes (total)	2.1 J	2.6 J	0.11	---
<b>SEMI-VOLATILE ORGANICS– detected substances only</b>				
bis (2-ethylhexyl) phthalate	26 J	14 J	20 J,B	---
Diethyl phthalate	8.1 J	7.8 J	ND(50)	---
Phenol	30 J	25 J	ND(25)	---
<b>HYDROCARBONS</b>				
Oil & Grease (EPA 1664-HEM)	50000 B	32000 B	NT	36
Total Aromatic Hydrocarbons as BETX from EPA Method 624	16.6	19.0	0.69	-14

**Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 13 and 14 August 2008. (continued)**

<b>Pollutant</b>	<b>Influent<sup>a</sup> (µg/L)</b>	<b>Effluent<sup>a</sup> (µg/L)</b>	<b>Sludge<sup>a</sup> (µg/g)</b>	<b>Percent Removal</b>
<b>DISSOLVED METALS</b>				
Antimony	0.21 J	0.33 J	NT	---
Arsenic	0.57 J	2.2 J	NT	---
Beryllium	ND (1.0)	ND (1.0)	NT	---
Cadmium	0.67 J	ND (1.0)	NT	---
Chromium	3.0	3.5	NT	-17
Copper	7.9	15	NT	-90
Lead	0.24 J	0.64 J	NT	---
Mercury	ND (0.20)	ND (0.20)	NT	---
Molybdenum	1.2 J	4.2	NT	-250
Nickel	2.8	2.8	NT	0
Selenium	2.1 J	2.5 J	NT	---
Silver	0.31 J	0.59 J	NT	---
Thallium	0.036 J	ND (1.0)	NT	---
Zinc	14	27	NT	-93
<b>TOTAL METALS</b>				
Antimony	0.48 J	0.47 J	1.5	---
Arsenic	2.1 J	2.2 J	5.4	---
Beryllium	ND (1.0)	ND (1.0)	0.14 J	---
Cadmium	6.8	0.60 J	1.8	91
Chromium	3.9 B	2.2 B,J	13	44
Copper	60	37	240	38
Lead	4.0	2.3	21	42
Mercury	0.11 J	0.041 J	0.62	---
Molybdenum	4.5	4.5	5.6	0
Nickel	4.2	3.2	12 L	24
Selenium	1.6 J	ND (5.0)	3.8 B	---
Silver	1.8	1.4	7.1	22
Thallium	ND (1.0)	ND (1.0)	0.071 J	---
Zinc	170 B	110 B	690	35



**Table 10. Toxic Pollutants and Pesticides in the Influent, Effluent, and Sludge, Sampled 13 and 14 August 2008. (continued)**

Pollutant	Influent <sup>a</sup> (µg/L)	Effluent <sup>a,b</sup> (µg/L)	Sludge <sup>a</sup> (µg/g)	Percent Removal
<b>PESTICIDES – detected substances only</b>				
alpha-BHC	ND(0.050)	0.0082 J,COL	ND(0.007)	---
beta-BHC	ND(0.050)	0.036 J,COL	ND(0.007)	---
Endosulfan sulfate	ND(0.10)	ND(0.10)	0.0087 COL	---
<b>ENTEROCOCCI BACTERIA</b>				
Enterococci <sup>c</sup>	NT	[<2/<2]/[<2/<2]	NT	---
<b>OTHER COMPONENTS</b>				
Asbestos <sup>d</sup>	ND (50)	ND (10)	ND	---
Cyanide	ND (10)	6.9 J	0.42 J	---
Dioxin (2,3,7,8-TCDD)	ND (0.00037)	ND (0.00023)	ND (0.000061)	---

*a* Detection or reporting limits are included where possible in parentheses for non-detected (ND) values

*b* Duplicate field sample analysis or duplicate laboratory analysis provided (value/duplicate value)

*c* Enterococci reported in CFU/100 mL

*d* Asbestos reported in million fibers/L (influent and effluent) and present or none detected (sludge)

--- Not applicable (not calculated)

J Estimated value (below MRL but above MDL)

B Method blank contamination.

L Serial dilution of a digestate in the analytical batch indicates that physical and chemical interferences are present.

COL More than 40 % RPD between primary and confirmation columns results. [The lower of the two results is reported.]

ND None detected

NT Not tested

of toluene, tetrachloroethene, 1,4-dichlorobenzene, and quantifiable (non-estimated) concentrations of bis (2-ethylhexyl) phthalate. An estimated concentration of phenanthrene was also seen in the sludge sample for June 2008, but this compound was not detected in the influent or effluent for this sampling event. In August 2008, of those compounds that were detected in either the influent or effluent; 1,4-dichlorobenzene, methylene chloride, tetrachloroethene, toluene, total xylenes, and bis (2-ethylhexyl) phthalate were also seen in the sludge. In addition, 1,2-dichlorobenzene, and ethylbenzene were detected in the sludge in August 2008, although they were not detected in either the influent or effluent during this sampling event. Again, most of these concentrations were estimated and qualified with a J as they fell below MRLs.

Oil and grease concentrations measured in the influent and effluent in 2008 using EPA 1664A HEM were similar to those seen in 2003 through 2007 with effluent concentrations of 28 and 32 mg/L during the June and August sampling, respectively. Oil and grease effluent concentrations from 2003 and 2007 ranged from 15-35 mg/L. Effluent BETX concentrations as measured by EPA 624 were 17.1 and 19.0 µg/L in the June and August 2008 samplings, respectively. Total aromatic hydrocarbons as BETX (EPA 602) and PAHs were also sampled in the effluent as part of the receiving water program in June and were measured at 10.3 µg/L. Refer to Sections 5.1 and 5.2 for further discussion of the significance of the total hydrocarbon values.

The AWQS have site-specific criteria for the Point Woronzof area that are based on dissolved metals in the receiving water. These SSWQC were utilized to determine the MAEC (defined as the value specified as the receiving water limit and/or the permit limit multiplied by the initial dilution of 142:1 for conservative substances and 180:1 for non-conservative substances after taking into account the natural background concentration). Both total and dissolved concentrations of metals in the effluent were then compared to the MAECs.

Total metals concentrations in both the influent and effluent were found to be low. Influent and effluent concentrations of total antimony, arsenic, beryllium, mercury, selenium, and thallium were either not detected or estimated values that were below detection limits during both sampling periods. Other total recoverable metals such as, cadmium, chromium, copper, lead, molybdenum, nickel, silver, and zinc were seen in the influent or effluent during both sampling events, but at very low levels when compared to their respective MAECs.

Dissolved metals concentrations were also found to be low. Dissolved antimony, arsenic, beryllium, cadmium, lead, mercury, selenium, silver, and thallium were found to be below detection limits for both influent and effluent during both sampling periods. Dissolved copper, and nickel were above detection limits in both influent and effluent during both sampling events, while dissolved chromium was reported above the detection limit in the influent and effluent only during the August sampling and dissolved zinc was above detection limits except for an estimated value in the June influent sampling. Dissolved molybdenum was seen at low levels in the influent and effluent during both the June and August 2008 sampling. The concentration for dissolved copper in effluent was found to be the highest of any of the metals with respect to its MAEC of 317 µg/L, with a level of 15 µg/L during the August sampling. While dissolved copper was found to be the highest metal detected in the effluent with respect to its MAEC, it was still over an order of magnitude less than the MAEC.

Several pesticides were detected in the influent, effluent, or sludge during the June and August 2008 sampling events. All concentrations of pesticides that were detected in the influent or effluent were at levels below the MDL (therefore qualified with a J). During the June sampling,

malathion was detected only in the influent and methoxychlor was detected only in the sludge. During the August sampling, alpha-BHC and beta-BHC were detected only in the effluent and endosulfan sulfate was detected in the sludge. No PCBs or DDTs were detected in either the June or August sampling. For a complete list of the various pesticide analytes, refer to Appendices A1 and B1.

The permit calls for the analysis of enterococci bacteria in effluent twice per year in conjunction with the summer dry and summer wet sampling. The enterococci in the effluent was reported as ranging from <2 to 13 most probable number (MPN)/100 mL in the four samples analyzed for the June 2008 sampling and <2 MPN/100 mL for both replicates and laboratory sample duplicates taken during the August 2008 sampling event.

Asbestos was not detected in influent, effluent, or sludge during either sampling event. The concentration of cyanide in the influent and effluent was below the detection limit of 10 µg/L during both the June and August 2008 sampling events. The highest estimated concentration of cyanide that was seen in the effluent was during the June sampling event at 9 µg/L. Effluent cyanide concentrations were lower than that seen in 2007 and both years were still well below the MAEC of 181 µg/L. Cyanide was detected in sludge at estimated concentrations of 0.71 µg/g in June 2008 and at 0.42 µg/g in the August 2008 sampling event. Dioxins (2,3,7,8-TCDD) were tested in influent, effluent, and sludge during both sampling events, but none were detected.

### **3.1.3 Pretreatment Monitoring Data**

As part of the NPDES permit, AWWU is to conduct pretreatment monitoring twice per year in conjunction with the toxic pollutant and pesticide analyses. This monitoring includes three consecutive days of 24-hr composite sampling of the influent and effluent. Pretreatment analyses include cyanide and a suite of metals that are analyzed as both total and dissolved. Results of the pretreatment monitoring are presented in Table 11.

Collection of samples for trace metals analysis, as part of the toxic pollutant and pesticide sampling events in June and August 2008, coincided with the first day of the pretreatment monitoring performed by TestAmerica for the Asplund WPCF during 2008, as discussed in Section 3.1.2. Metals concentrations for the two additional days of each 3-day pretreatment sampling event were typically similar to those discussed above, particularly for the effluent.

Of all the metals in the effluent, total copper and zinc concentrations were the highest, but values for these metals were still well below their respective MAECs. For example, dissolved copper in the effluent was reported at concentrations of 12 - 14 µg/L during the three days of pretreatment sampling in June 2008 and a range of 15 - 20 µg/L during the August sampling effort as compared to the MAEC of 317 µg/L. Total copper in the effluent was found to range from 35 to 41 µg/L for the six pretreatment samples compared to the MAEC of 317 µg/L. Influent values were generally more variable than those seen in effluent, as would be expected. Dissolved zinc in the effluent ranged from 9 - 27 µg/L during both pretreatment samplings, while total zinc ranged from 79 - 120 µg/L during these samplings as compared to an MAEC of 11,249 µg/L. Dissolved and total mercury were below reporting limits of 0.2 µg/L in all six effluent pretreatment samples, as compared to the MAEC of 2.73 µg/L. Other metals were also found to be substantially less than their respective MAECs. Total cyanide was not detected above the reporting limit (10 µg/L) in any of the six effluent pretreatment samples, as compared to an MAEC of 181 µg/L although some lower level estimated values were reported.

**Table 11. Pretreatment Monitoring Data for Influent and Effluent Metals and Cyanide.**  
Concentrations are in µg/L.<sup>a</sup>

Parameter	June 2008						August 2008					
	Influent			Effluent			Influent			Effluent		
Sample Date	18	19	20	18	19	20	13	14	15	13	14	15
<b>Dissolved Metals</b>												
Antimony	0.20 J	0.24 J	0.23 J	0.39 J	0.34 J	0.30 J	0.21 J	0.18 J	0.35 J	0.33 J	0.35 J	0.43 J
Arsenic	< 5.0	< 5.0	< 5.0	< 5.0	0.55 J	< 5.0	0.57 J	0.53 J	0.70 J	2.2 J	1.9 J	1.3 J
Beryllium*	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	< 1.0	< 1.0	0.085 J	< 1.0	< 1.0	0.21 J	0.67 J	< 1.0	0.040 J	< 1.0	0.050 J	0.041 J
Chromium	1.2 J	1.2 J	1.2 J	1.1 J	1.4 J	1.3 J	3.0	2.1 J	2.1 J	3.5	2.9 J	2.3 J
Copper	6.5	6.4	7.5	14	12	13	7.9	9.6	14	15	17	20
Cyanide	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Lead	0.29 J	0.21 J	0.25 J	0.78 J	0.63 J	0.54 J	0.24 J	0.27 J	0.37 J	0.64 J	0.66 J	0.67 J
Mercury	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	1.6 J	1.1 J	1.4 J	6.4	4.9	4.6	1.2J	1.0 J	4.2	4.2	4.7	10
Nickel	2.2	2.0	1.9 J	2.7	2.5	2.0	2.8	2.3	2.7	2.8	2.7	3.0
Selenium	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	2.1 J	< 5.0	< 5.0	2.5 J	< 5.0	< 5.0
Silver	0.21 J	0.24 J	0.33 J	0.51 J	0.63 J	0.71 J	0.31 J	0.31 J	0.51 J	0.59 J	0.70 J	0.83 J
Thallium	0.040 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.036 J	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	7.0 J	7.0 J	8.5 J	20	20	9.0 J	14	15	19	27	11	14
<b>Total Metals</b>												
Antimony	1.1 J	0.78 J	0.70 J	0.57 J	0.56 J	0.56 J	0.48 J	0.48 J	0.86 J	0.47 J	0.40 J	0.56 J
Arsenic	3.2 J	1.8 J	2.2 J	2.5 J	2.2 J	2.4 J	2.1 J	2.4 J	2.6 J	2.2 J	2.8 J	1.9 J
Beryllium*	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	0.67 J	0.27 J	1.8	0.51 J	0.26 J	4.9	6.8	0.46 J	0.35 J	0.60 J	0.53 J	0.22 J
Chromium	8.0 B	3.9 B	5.3 B	2.3 B,J	2.4 B,J	2.9 B,J	3.9 B	5.0 B	4.5 B	2.2 B,J	3.0 B	2.5 B,J
Copper	92	55	56	36	35	37	60	64	71	37	37	41
Cyanide	2.5 J	2.5 J	3.2 J	9.0 J / (0.19J/ 0.25J)	6.4 J	7.8 J	< 10	< 10	< 10	6.9 J	< 10	2.7 J
Lead	13	4.1	4.2	2.8	2.4	2.1	4.0	3.7	4.2	2.3	2.0	1.8
Mercury	0.14 J	0.12 J	0.19 J	0.047 J	0.068 J	0.059 J	0.11 J	0.069 J	0.096 J	0.041 J	0.046 J	0.076 J
Molybdenum	9.8 B	4.6 B	4.5 B	6.4 B	4.6 B	4.8 B	4.5	4.3	12	4.5	4.8	11
Nickel	6.5	3.9	4.7	2.5	2.4	3.1	4.2	4.0	4.7	3.2	3.1	2.8
Selenium	1.3 J	< 5.0	< 5.0	1.3 J	1.2 J	< 5.0	1.6 J	2.1 J	1.6 J	< 5.0	2.0 J	< 5.0
Silver	3.2	2.2	2.0	1.3	1.4	1.6	1.8	1.9	2.3	1.4	1.5	1.7
Thallium	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	290	160	170	120	120	110	170 B	160 B	170	110 B	87 B	79

<sup>a</sup> Duplicate lab analyses provided (value/duplicate value)

\* Not required by permit for "Pretreatment" monitoring

NT Not tested B = Blank contamination J = Estimated value

Values reported as "<" (less than), are reporting limits

### 3.1.4 Whole Effluent Toxicity Testing Results

Quarterly WET testing was conducted on 24-hr flow composite effluent samples as required under the permit during all four quarters of calendar year 2008. Echinoderm fertilization tests were performed using the purple sea urchin, *Strongylocentrotus purpuratus*, during the first, second, and third quarters of 2008. Use of this test during the first, second, and third quarters was based on the screening test results from the third quarter of 2007 which had determined the sea urchin to be the most sensitive species tested (see Section 2.1.4). Annual re-screening for the most sensitive species in 2008 was performed during the fourth quarter, and both the sea urchin and one endpoint on the topsmelt were found to be similarly sensitive. Based on interpretation of the detailed laboratory results, the laboratory recommended continuing with the sea urchin as the most sensitive species for the 2009 testing.

Results of all the tests performed in 2008 are summarized below and presented in Table 12 as the lowest observed effect concentration (LOEC), no observed effect concentration (NOEC), and in chronic toxicity units (TUC), where  $TUC = 100/NOEC$ . Detailed results in the form of descriptive laboratory reports that present all data in tabular form along with statistical analyses, QA/QC information, and reference toxicant test results have previously been submitted to ADEC and EPA with Asplund WPCF's monthly discharge monitoring reports (DMRs) and are not duplicated here in this report.

**Table 12. Summary of WET Test Data from 2008.**

Toxicity Test	LOEC (%)	NOEC (%)	TUC
<b>1<sup>st</sup> Quarter 2008</b>			
Echinoderm (fertilization)	2.8	1.4	71.4
<b>2<sup>nd</sup> Quarter 2008</b>			
Echinoderm (fertilization)	2.8	1.4	71.4
<b>3<sup>rd</sup> Quarter 2008</b>			
Echinoderm (fertilization)	2.8	1.4	71.4
<b>4<sup>th</sup> Quarter 2008</b>			
Bivalve (survival)	> 2.8	$\geq 2.8$	$\leq 35.7$
Bivalve (development)	> 2.8	$\geq 2.8$	$\leq 35.7$
Topsmelt (survival)	2.8	1.4	71.4
Topsmelt (growth)	> 2.8	$\geq 2.8$	$\leq 35.7$
Echinoderm (fertilization)	2.8	1.4	71.4

First quarter 2008 echinoderm fertilization testing was performed on a single 24-hr composite sample collected on 28-29 January 2008. Results from this sample showed a significant decrease in egg fertilization at the 2.8 % effluent sample concentration with an LOEC of 2.8 % and a NOEC of 1.4 % effluent. The TUC was 71.4, which was well within the permit maximum allowable limit of 143.

The WET testing for the second quarter with echinoderms was performed on samples collected 14-15 April 2008. Results of the second quarter testing were the same as that seen in the first

quarter with the sample showing a significant decrease in egg fertilization at the 2.8 % effluent sample concentration with an LOEC of 2.8 % and a NOEC of 1.4 % effluent. The TUC was 71.4, which was well within the permit maximum allowable limit of 143.

The third quarter testing with echinoderms was performed on samples collected 17-18 August 2008. Results of the third quarter WET testing showed a significant decrease in egg fertilization at the 2.8 % effluent sample concentration with an LOEC of 2.8 % and a NOEC of 1.4 % effluent. The TUC was 71.4, which was well within the permit maximum allowable limit of 143.

The three-species WET testing was performed during the fourth quarter of 2008. The test included: the bivalve larvae, *Mytilus galloprovincialis*, survival and development; topsmelt, *Atherinops affinis*, survival and growth; and echinoderm, *Strongylocentrotus purpuratus* fertilization. The testing was performed on effluent samples collected from 4 November to 9 November 2008.

Results of the bivalve testing showed that no concentration of effluent that was tested produced any toxicity to the test organisms. The NOECs for both survival and development were  $\geq 2.8$  % effluent and both LOECs were  $> 2.8$  % effluent. Chronic toxicity units were  $\leq 35.7$  TUC for both survival and development in the bivalves. Both reference toxicant tests were within laboratory control chart limits and indicated typical sensitivity of the test population.

The topsmelt bioassay showed significantly decreased fish survival in the 2.8 % concentration, but no decrease in growth (biomass) in any concentration compared with seawater-only controls. The NOEC for survival was 1.4 %, and for growth was  $\geq 2.8$  %; the LOECs were 2.8 % and  $> 2.8$  %, respectively. The effluent therefore showed 71.4 TUC in the survival endpoint and  $\leq 35.7$  TUC in the growth endpoint. The concurrent reference toxicant test results were within laboratory control chart limits and indicated typical sensitivity of the test population. All test acceptability criteria (TAC) were met in both the effluent bioassay and the reference toxicant bioassay.

Results of the echinoderm fertilization test conducted during the third quarter showed that significant decrease in egg fertilization occurred at the 2.8 % effluent concentrations when compared to the seawater-only controls. The NOEC for fertilization was therefore 1.4 % and the LOEC was 2.8 %, with a TUC of 71.4, meeting the allowable permit limit of not exceeding 143. Based on the results of the three-species testing and past years' results it was recommended to continue to use the urchin as the most sensitive species for the toxicity testing to be conducted in 2009 until the three-species comparison is repeated.

### **3.1.5 Part 503 Sludge Monitoring Data**

The AWWU operates a sludge incinerator at the Asplund WPCF for which the NPDES permit requires sludge monitoring twice per year as part of the "Toxic Pollutants and Pesticides/Pretreatment" sampling requirements. As described in Section 2.1.5, AWWU performed Part 503 sludge monitoring with a minimum frequency of once every 60 days. These data will be submitted along with other incinerator operational information to EPA by 19 February 2009. This submittal will take the form of a separate report; however, for completeness and for comparison purposes, this information has been included here as well.

Results of the sludge monitoring for metals for the year are presented in Table 13. Metals concentrations were extremely low compared to allowable limits and very similar to those seen historically. The only metal that had historically been elevated for some sampling events was arsenic. In 2008, the highest concentration of arsenic in the sludge was 5.40 mg/kg compared to the allowable limit of 99 mg/kg. As mentioned above, no actual limits exist in the current NPDES permit. Allowable limits are site-specific and were calculated by the permittee per Part 503 regulations (CH2M Hill 2008). EPA plans to issue sludge only permits in the future; in the interim, 40 CFR Part 503 regulations are “self-implementing”.

### **3.2 RECEIVING WATER QUALITY MONITORING RESULTS**

Water quality sampling of the receiving water was conducted on 17 - 18 June 2008, concurrent with the summer dry sampling. Sampling results are contained in the following subsections.

#### **3.2.1 Plume Dispersion Sampling**

##### **Drogue Tracking Results**

Drogues were released on 17 June 2008 at the ZID station for the ebb and flood tidal cycles and on 18 June 2008 at the control station for the flood tidal cycle. Three drogues were deployed during each tidal cycle.

##### **ZID Site**

The Point Woronzof ebb drogue drop and tracking cycles were performed during the morning of 17 June 2008. The predicted tidal range during ebb stage was 29.35 feet (Figure 5 and Table 14; NOAA Tides and Currents, 2008). A composite of the ebb drogue deployments is depicted in Figure 6 and are very similar to that seen in previous years.

The ebb drogues traveled from approximately 2.0 to 3.5 nautical miles, all three traveling in a southwesterly direction. No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first ebb (E1) drogue was released at 07:15 Alaska Daylight Time (ADT), about 21 minutes after high tide. This drogue tracked southwest and then more southerly between shore and south of the shoal that was evident at low tide. This drogue traveled at approximately 70 centimeters per second (cm/s) over its entire track of approximately 2.0 nautical miles. The second ebb drogue (E2) was released at 08:55 ADT and tracked well north of the shoal, traveling west southwest with an average speed of 104 cm/s over the entire track, traveling approximately 3.0 nautical miles. The third drogue (E3) was released at 10:53 ADT just at 4 hours after high slack. The third drogue followed a similar path to the E2 drogue traveling in a west southwesterly direction. This drogue traveled approximately 3.5 nautical miles at 110 cm/s over its entire track.

Flood drogue tracks are depicted in Figure 7. The tidal range during flood stage was 29.16 feet (Figure 5 and Table 14; NOAA, 2008). No eddies were observed during these drogue tracks, nor did any of the drogues become grounded during their tracks. The first flood drogue (F1) was deployed on 17 June at 14:15 ADT at low slack water at the outfall and tracked until 15:42 ADT. This drogue traveled easterly along the shoreline on the lee side of Point Woronzof for approximately 1.8 nautical miles at an average speed of 54 cm/s before entering the shallow

**Table 13. Part 503 Discharge Monitoring Data for Sludge Metals.** Concentrations are in mg/kg dry weight. All metals are reported as total metals.

Parameter <sup>1,6,7</sup>	Arsenic	Beryllium <sup>3,5</sup>	Cadmium	Chromium	Lead	Mercury <sup>4,5</sup>	Nickel
<b>Site Specific Limit 2008<sup>2</sup></b>	99	2014	88	1937	5045	129	6727
02/16/08	ND(<3.24)	ND(<0.324)	1.38	10.5	23.5	1.930	8.34
04/14/08	3.30	ND(<0.309)	1.36	14.3	23.8	0.844	11.6
06/17/08 <sup>8</sup>	4.70	(0.080J)	1.40	24.0	19.0	0.900	11.0
06/30/08	5.07	ND(<0.330)	1.28	12.4	31.2	NT <sup>9</sup>	12.9
08/12/08	5.18	ND(<0.335)	1.41	13.9	19.0	0.473	12.5
08/14/08 <sup>8</sup>	5.40	(0.140J)	1.80	13.0	21.0	0.620	12.0
11/22/08	ND(<3.51)	ND(<0.351)	1.02	12.0	17.9	0.563	10.1
12/16/08	ND(<4.17)	ND(<0.417)	1.12	9.77	15.4	0.357	13.6
MINIMUM	ND	ND	1.02	9.77	15.4	0.357	8.34
MAXIMUM	5.40	ND	1.80	24.0	31.2	1.93	13.6
AVERAGE	4.73	ND	1.35	13.7	21.4	0.812	11.5

1) EPA = Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, EPA. Samples for total metals analysis, with the exception of mercury, were prepared (acid digestion) according to EPA method 3050, SW-846.

2) Site-specific sludge limits calculated by CH2MHill May 2008, based primarily on October 2007 Asplund Incinerator Source Test.

3) Beryllium emissions shall not exceed 10 grams per day. With a control efficiency of 0.9998 at the maximum sludge feed rate, a sludge concentration of 500 milligrams per dry kilogram of sludge will not result in a violation of the limit.

4) Mercury emissions shall not exceed 3,200 grams per day. With a control efficiency of 0.0 at the maximum sludge feed rate, a sludge concentration of 9.63 milligrams per dry kilogram of sludge will not result in a violation of the limit.

5) Monitoring frequencies required by 40 CFR Part 503 for incineration are once per 60 days for arsenic, cadmium, chromium, lead, and nickel. Mercury is at least once per year. Frequency for beryllium is not specified. AWWU has chosen to test mercury and beryllium more frequently than required to be consistent with the other metals.

6) February 13, April 14, June 30, August 12, November 22, and December 16 samples were analyzed by SGS - EPA 6020, Mercury by EPA 7471A and/or 7471B methods. Parentheses contain PQL values.

7) June 17 and August 14 were samples analyzed by Test America - EPA 6000/7000 Series Method in sludge, Mercury by EPA 7471A. Parentheses contain MRL values.

8) Samples analyzed by Test America

9) NT = not tested



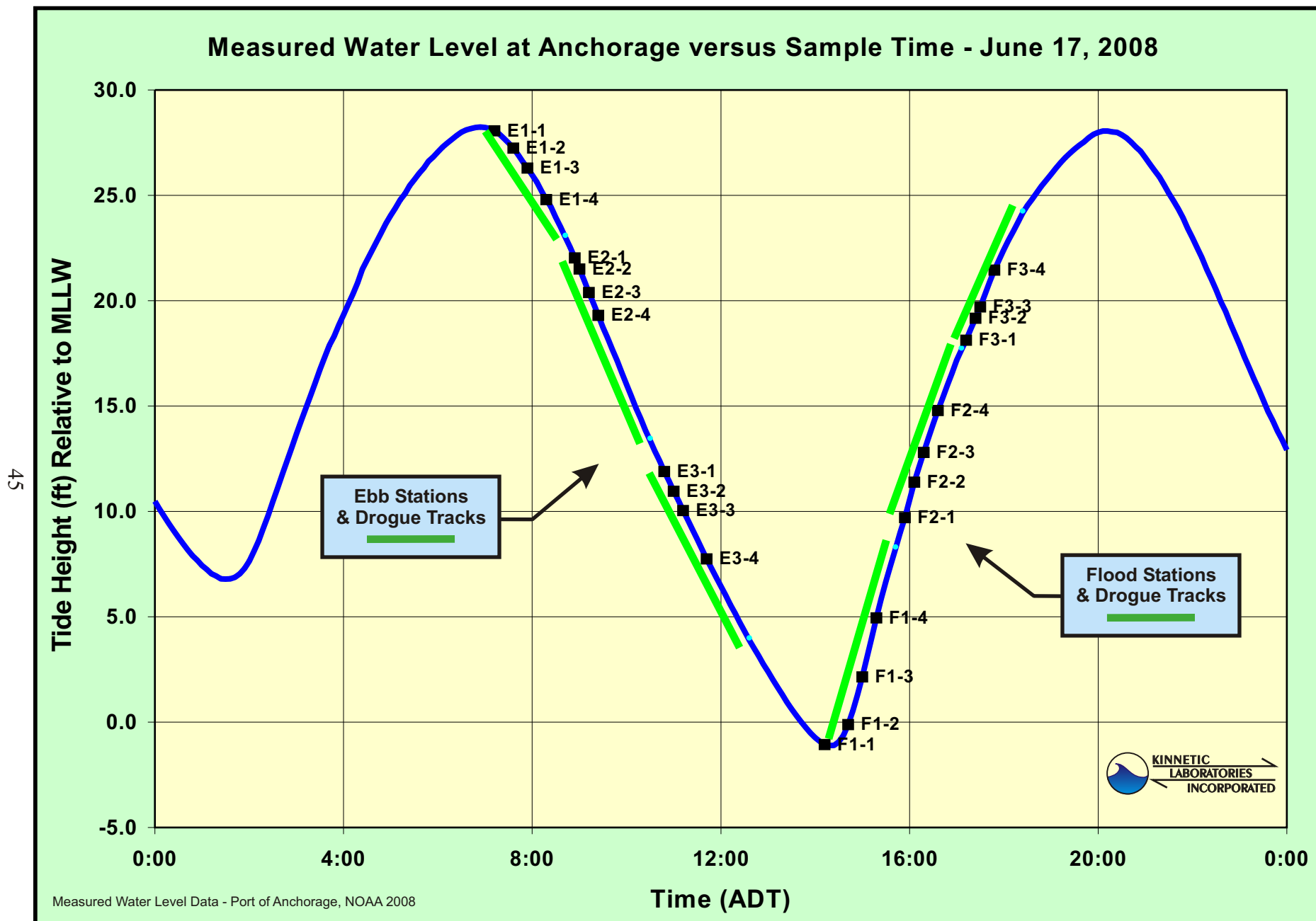


Figure 5. Tidal Information for Receiving Water Sampling, Ebb and Flood Tides.

**Table 14. 2008 Drogue Tracking Information.**

DATE	STATION	TIDAL INFORMATION				DROGUE NO.	RELEASE TIME AFTER SLACK (HOURS:MINUTES)	DROGUE SPEED (CM/S)
		Slack Water (Alaska Daylight Time <sup>a</sup> ; Stage)		Direction	Range (Feet) <sup>b</sup>			
17 June 2008	ZID	0654	HIGH	EBB	29.35	E1	00:21	70
17 June 2008	ZID	0654	HIGH	EBB	29.35	E2	02:01	104
17 June 2008	ZID	0654	HIGH	EBB	29.35	E3	03:59	110
17 June 2008	ZID	1418	LOW	FLOOD	29.16	F1	-00:03	54
17 June 2008	ZID	1418	LOW	FLOOD	29.16	F2	01:39	58
17 June 2008	ZID	1418	LOW	FLOOD	29.16	F3	02:56	108
18 June 2008	CONTROL	1500	LOW	FLOOD	29.82	C1	-00:07	43
18 June 2008	CONTROL	1500	LOW	FLOOD	29.82	C2	01:34	115
18 June 2008	CONTROL	1500	LOW	FLOOD	29.82	C3	02:58	239

<sup>a</sup> NOAA Tides and Currents 2008. (Port of Anchorage, Anchorage)

<sup>b</sup> Observed water level variations during tide.

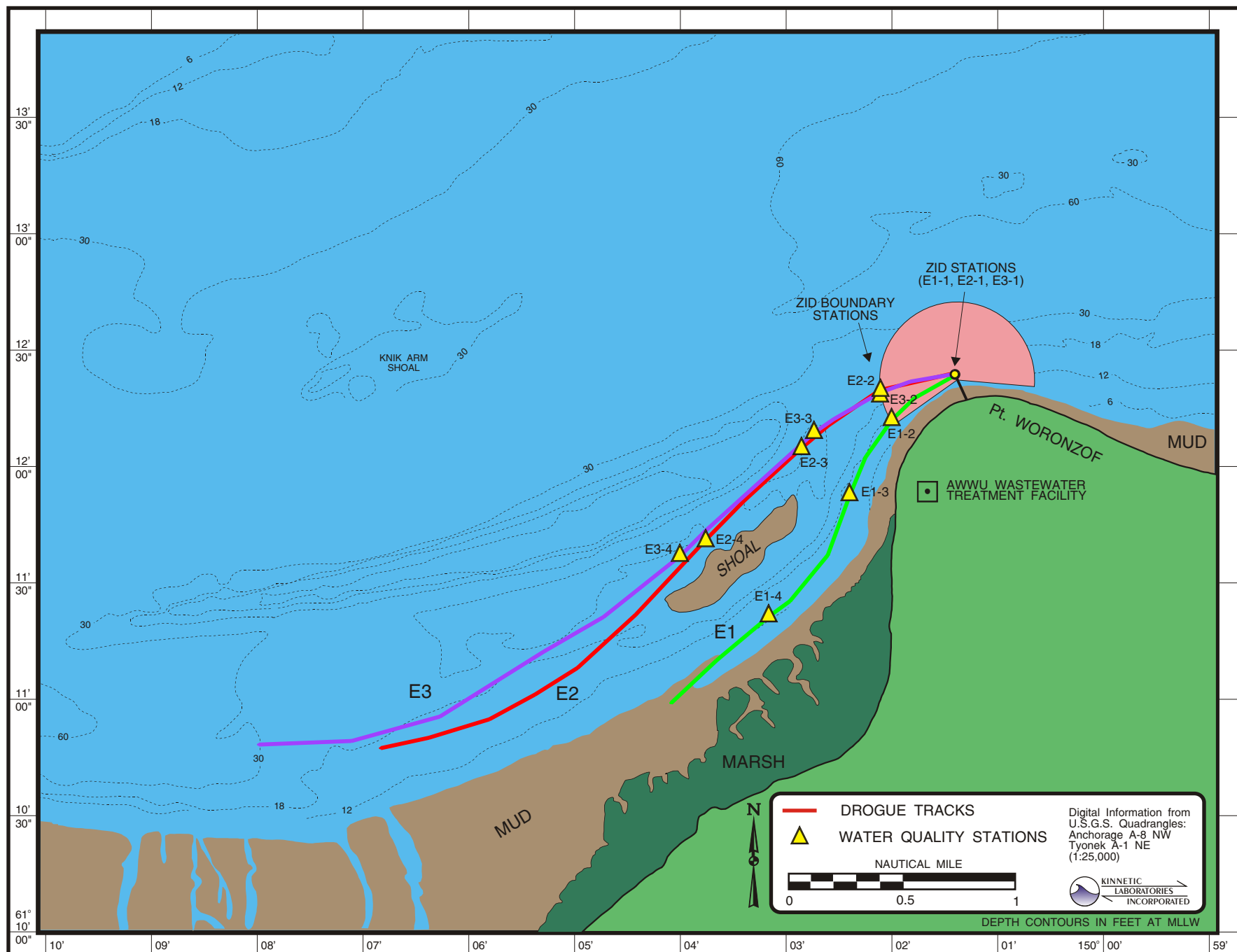


Figure 6. Summary of Ebb Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 17 June 2008.

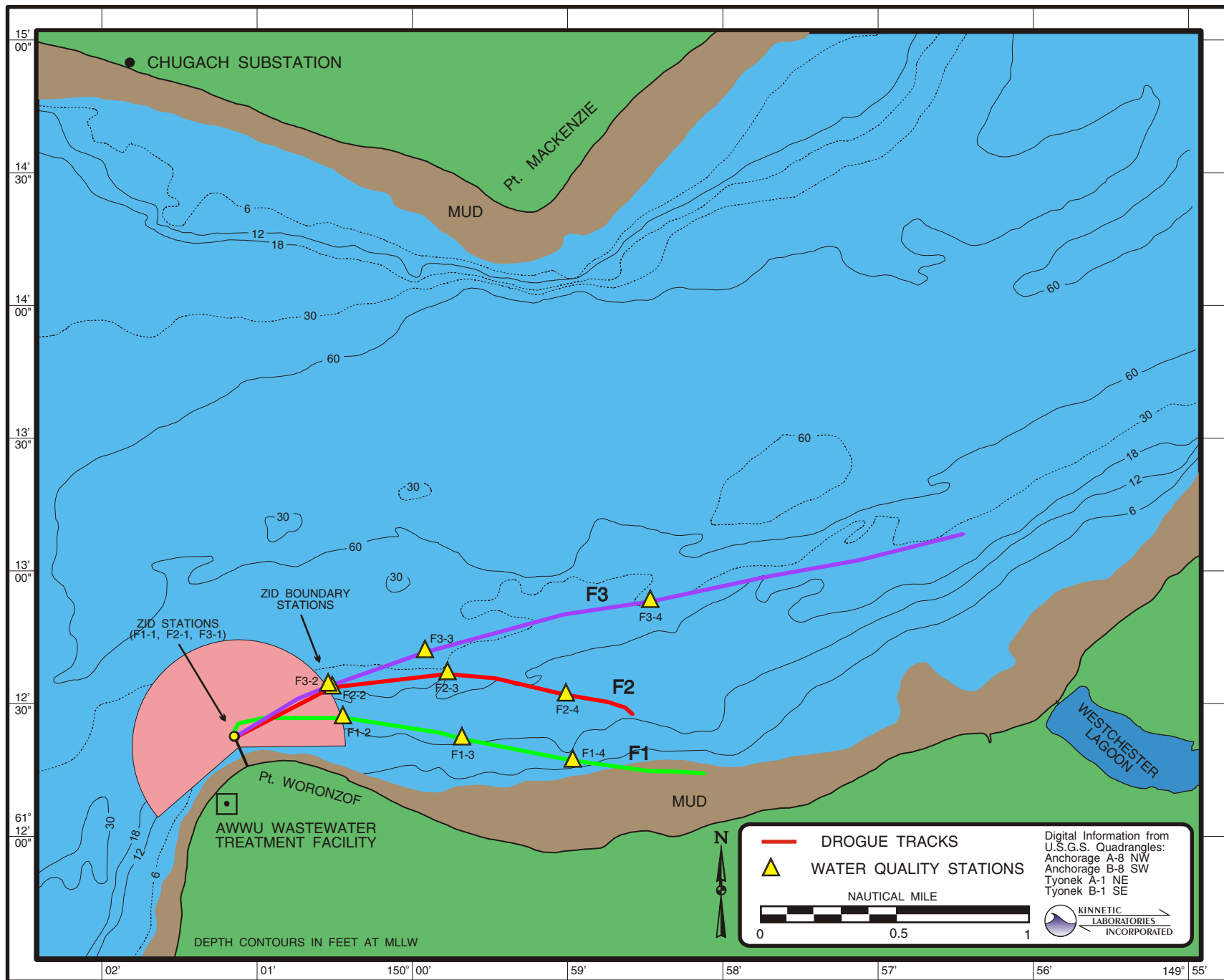


Figure 7. Summary of Flood Drogue Tracks and Receiving Water Sampling Locations at Point Woronzof, 17 June 2008.

intertidal area where it was retrieved. The second flood drogue (F2) was deployed at 15:57 ADT, approximately 1 hour 39 minutes after low slack. This drogue was transported initially to the northeast then easterly and further offshore than the first drogue for about 1.5 nautical miles at an average speed of 58 cm/s before it was recovered at 17:07 ADT.

The third flood drogue (F3) was deployed at 17:14 ADT, at just under 3 hours after low slack water, and tracked just over 1 hour until recovery at 18:23 ADT. The third drogue traveled in a northeast direction as had the second drogue for more than a mile, then moved further out from the shoreline, where it continued moving northeast in the central Knik Arm Channel with an average speed of 108 cm/s. This drogue was tracked for approximately 2.75 nautical miles and was recovered 0.5 nautical miles offshore and to the northwest of Westchester Lagoon.

### **Control Site**

The Point MacKenzie control drogues were deployed and tracked on 18 June 2008. The predicted tidal range during the flood tide was 29.82 ft. Tidal information is provided in Figure 8 and Table 14 (NOAA, 2008). A composite of the three drogue trajectories is presented in Figure 9 which is very similar to prior years.

All three control drogues had similar tracks with the first drogue (C1) tracking closer to shore. The first drogue was released at 14:53 ADT, right at slack water, and traveled to the east and then to the northeast along the shoreline. After traveling approximately 1.5 nautical miles, the drogue appeared to have become grounded nearshore and was picked up at 16:21 ADT. This drogue had an average speed of 43 cm/s over the entire track. The second drogue (C2) was released at 16:34 ADT, 1 hour and 34 minutes into the flood tidal cycle, and tracked until recovery at 17:40 ADT. This drogue had an average speed of 115 cm/s over the entire track and moved towards the northeast offshore of the first drogue and more in mid-channel traveling just over 2.5 nautical miles. The third control drogue (C3) was released at 17:58 ADT, just under 3 hours after high slack water. The drogue traveled in a manner similar to the second drogue and slightly further offshore, moving northeast into the central channel with an average speed of 239 cm/s. Abreast of Cairn Point, the drogue turned more toward the north for the last part of its trajectory, traveling over 4.5 nautical miles in all.

### **Summary of Water Quality Data**

The summer water quality sampling for all analysis types was conducted concurrently with the drogue tracking studies on 17 - 18 June 2008. As discussed previously, three drogues were released at the ZID for both ebb and flood tides and three were released at the control site for the flood tide. Water samples and CTD measurements were obtained at four stations along each drogue's track prior to their being retrieved. In the current NPDES permit, the ZID boundary is located 650 m distance from the outfall diffuser. To accomplish the ZID site sampling, the vessel was positioned directly upcurrent from the diffuser and allowed to drift down across it. Upon reaching the outfall diffuser, the drogue was dropped and the within-ZID station sampled. The distance from the outfall diffuser was monitored with the DGPS, and upon reaching 650 m distance from the diffuser, the ZID-boundary station was sampled. The third and fourth stations were then sampled along the drogue's path. Due to high current speeds, anchoring the vessel and sampling at each station was not practical or desirable for this type of sampling.

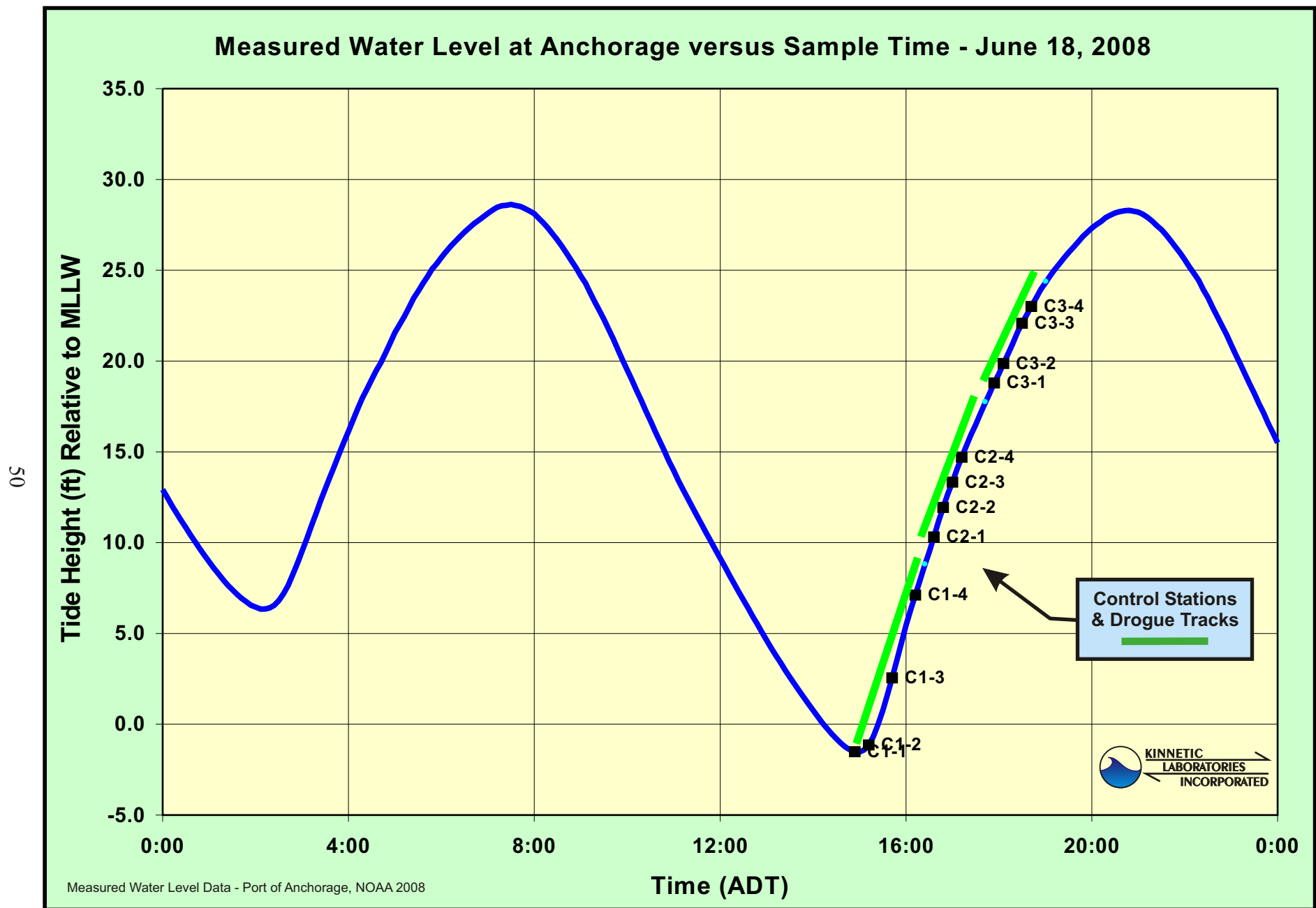


Figure 8. Tidal Information for Receiving Water Sampling, Control Tide.

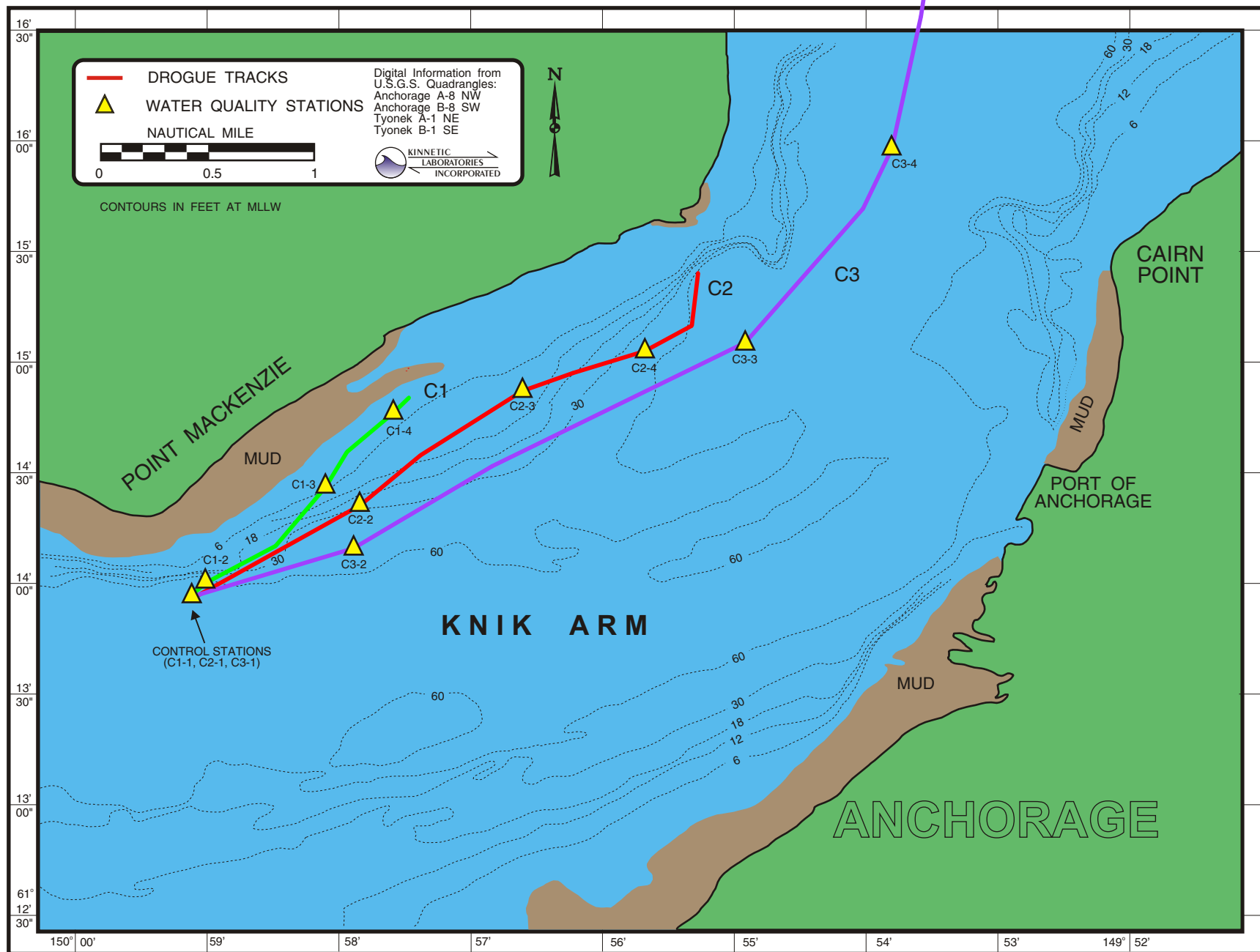


Figure 9. Summary of Control Drogue Tracks and Receiving Water Sampling Locations at Point MacKenzie, 18 June 2008.

Table 15 provides a summary of the water quality measurements obtained, where the station designation is represented by: drogue drop location (C=control, E=ebb, and F=flood), the first number represents the drogue number, and the second number represents the station along the drogue's path. The final character represents surface (S), mid-depth (M), or bottom (B) sample.

The waters of the inlet are extremely well-mixed both vertically and horizontally, as indicated by the CTD data. During the survey, temperatures ranged from a minimum of 10.52 °C to a maximum of 12.67 °C (Table 15). Salinities were found to vary from a minimum of 14.15 parts per thousand practical salinity units (psu) to a maximum of 18.02 psu. Salinities were generally found to increase slightly during the flood and decrease on the ebb, as is typical for estuaries. As has been seen often times in the past, the control stations were found to be slightly warmer and less saline due to a greater influence from river runoff. Values for pH ranged from 7.80 to 8.15 with little to no vertical stratification and slightly higher levels at the control site. Values for DO collected in-situ by the CTD ranged from 9.06 to 9.46 mg/L with most concentrations being at 100 percent saturation (UNESCO, 1973).

Representative hydrographic profiles of water quality are presented for a ZID boundary station during ebb tide, Station E1-2, and a typical control station, Station C2-1 (Figure 10). The water column was found to be well mixed from the surface to the bottom at all stations. Refer to Appendix C8 for hydrographic profile plots and detailed data from each water quality station.

Surface samples were obtained at each station for the analysis of color, TRC, fecal coliform bacteria, and turbidity. Color values were all found to be < 5 color units on the platinum-cobalt scale. In 2007, the highest color values ever observed over the 20-year history of the program were seen. These high values were believed to be the result of insufficient removal of suspended sediment and/or new equipment used by the laboratory as high levels were seen at both the outfall and control sites and are not the result of AWWU's discharge. In 2008, to circumvent the sediment removal problem, samples were allowed to settle and decanted prior to analysis.

During 2008, all receiving water TRC concentrations were below the MDL of 0.10 mg/L. It should be noted that the lowest MDL that was achievable by the laboratory due to seawater matrix interferences for TRC analysis in 2008 is higher than both the AWQS 1-hr average acute limit of 0.013 mg/L and the 4-day chronic limit of 0.0075 mg/L. The amperometric method that was used for the receiving water sampling is the preferred method since it is affected little by common oxidizing agents, temperature, turbidity, or color, but all TRC methods are subject to positive interferences in estuarine or marine waters. The average TRC concentrations of the effluent, collected every three hours for the sampling dates 17 and 18 June 2008 were 0.40 and 0.38 mg/L, respectively which are much lower than the MAEC based on the AWQS.

Fecal coliform values this year were quite low and ranged from < 2 to 23 FC MPN/100 mL. More than half of the fecal coliform concentrations were reported at  $\leq 2$ ; this included 20 out of 24 samples at the ebb and flood stations combined and 11 out of 14 samples at the control stations. The overall median for fecal coliform for all of the outfall stations (both ebb and flood) was <2.0 FC MPN/100 mL; the median at the control stations was < 2.0 FC MPN/100 mL.

Turbidity values for water samples collected during the monitoring ranged from a low of 32 Nephelometric Turbidity Units (NTU) to a high of 489 NTU.



**Table 15. Hydrographic and Water Quality Data, 17 and 18 June 2008.**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
<b>JUNE 17</b>												
E1-1S	0715	61° 12.343'	150° 01.267'	0.5	11.19	16.77	8.13	9.22	55	ND (5.0)	ND (0.10)	<2
-1M				5.0	11.16	17.05	8.15	9.32	187			
-1B				10.0	11.02	17.34	8.14	9.32	250			
E1-2S	0737	61° 12.149'	150° 01.884'	0.5	11.16	16.99	8.09	9.36	158	ND (5.0)	ND (0.10)	4
-2M				5.5	11.00	17.40	8.09	9.39	226			
-2B				11.0	10.52	18.02	8.08	9.45	353			
E1-3S	0753	61° 11.828'	150° 02.285'	0.5	11.18	16.99	8.06	9.38	67/61	ND (5.0)	ND (0.10)	<2
-3M				2.5	10.96	17.45	8.06	9.46	132			
-3B				5.0	10.76	17.73	8.05	9.43	271			
E1-4S	0817	61° 11.315'	150° 03.034'	0.5	11.11	16.98	8.04	9.36	32	ND (5.0)	ND (0.10)	<2
-4M				3.0	10.98	17.48	8.04	9.41	83			
-4B				5.5	10.61	17.91	8.04	9.44	408			
E2-1S	0855	61° 12.347'	150° 01.286'	0.5	11.15	17.05	7.99	9.37	349	ND (5.0)	ND (0.10)	<2
-1M				5.0	11.14	17.12	7.99	9.35	325/385			
-1B				10.0	11.14	17.12	7.99	9.32	376			
E2-2S	0901	61° 12.274'	150° 01.999'	0.5	11.15	17.04	7.99	9.40	378	ND (5.0)	ND (0.10)	<2
-2M				6.0	11.14	17.10	7.99	9.38	373			
-2B				11.5	11.12	17.16	7.99	9.37	337			
E2-3S	0908	61° 12.028'	150° 02.731'	0.5	11.13	16.94	7.99	9.43	336	ND (5.0)	ND(0.10)/ ND(0.10)	2
-3M				5.5	11.13	17.15	7.99	9.37	354			
-3B				11.0	11.12	17.17	7.99	9.34	346/342			

**Table 15. Hydrographic and Water Quality Data, 17 and 18 June 2008. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
E2-4S	0924	61° 11.639'	150° 03.639'	0.5	11.12	17.17	7.99	9.40	307	ND (5.0)	ND (0.10)	<2
-4M				5.5	11.11	17.21	7.99	9.39	326			
-4B				11.0	11.11	17.21	7.98	9.34	322			
E3-1S	1053	61° 12.342'	150° 01.295'	0.5	11.31	16.65	7.95	9.42	384	ND (5.0)	ND (0.10)	2
-1M				3.0	11.31	16.68	7.95	9.41	418			
-1B				5.5	11.30	16.69	7.95	9.34	411			
E3-2S	1102	61° 12.265'	150° 01.990'	0.5	11.34	16.60	7.95	9.41	371/379	ND (5.0) / ND (5.0)	ND (0.10)	<2
-2M				4.5	11.32	16.67	7.95	9.39	406			
-2B				9.0	11.30	16.72	7.95	9.39	418			
E3-3S	1114	61° 12.094'	150° 02.617'	0.5	11.33	16.66	7.95	9.39	318	ND (5.0)	ND (0.10)	2
-3M				4.0	11.33	16.67	7.94	9.39	391			
-3B				7.5	11.32	16.69	7.94	9.34	407			
E3-4S	1140	61° 11.572'	150° 03.877'	0.5	11.48	16.64	7.94	9.35	149	ND (5.0)	ND (0.10)	<2
-4M				4.5	11.33	16.68	7.94	9.38	383/392			
-4B				9.0	11.32	16.69	7.94	9.33	438			
F1-1S	1415	61° 12.356'	150° 01.295'	0.5	11.99	16.05	7.82	9.14	158	ND (5.0)	ND (0.10)	23
-1M				1.0	11.89	16.30	7.82	9.12	159			
-1B				1.5	11.84	16.32	7.81	9.06	181			
F1-2S	1444	61° 12.424'	150° 00.564'	0.5	11.96	16.21	7.86	9.34	172	ND (5.0)	ND (0.10)	13
-2M				1.5	11.95	16.21	7.86	9.35	178			
-2B				2.5	11.95	16.21	7.86	9.29	195/194			
F1-3S	1500	61° 12.346'	149° 59.812'	0.5	11.98	16.15	7.86	9.32	180	ND (5.0)	ND (0.10)	2
-3M				1.5	11.97	16.15	7.86	9.31	185			
-3B				2.5	11.96	16.16	7.86	9.24	189			

**Table 15. Hydrographic and Water Quality Data, 17 and 18 June 2008. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F1-4S	1515	61° 12.263'	149° 59.099'	0.5	12.04	16.14	7.85	9.31	156	ND (5.0)	ND (0.10)	<2
-4M				1.5	12.04	16.14	7.86	9.29	175			
-4B				3.0	12.04	16.14	7.86	9.24	179			
F2-1S	1557	61° 12.348'	150° 01.280'	0.5	---	---	---	---	363	ND (5.0)	ND (0.10)	2
-1M				2.5	---	---	---	---	322			
-1B				5.0	---	---	---	---	404			
F2-2S	1604	61° 12.537'	150° 00.651'	0.5	12.00	16.70	7.83	9.36	393	ND (5.0)	ND (0.10)	<2
-2M				5.5	11.99	16.66	7.83	9.35	489			
-2B				10.5	11.99	16.61	7.83	9.33	417			
F2-3S	1614	61° 12.588'	149° 59.909'	0.5	12.02	16.64	7.82	9.39	440	ND (5.0)	ND (0.10)	<2
-3M				4.5	12.03	16.59	7.82	9.38	433			
-3B				8.5	12.04	16.60	7.83	9.34	430			
F2-4S	1634	61° 12.510'	149° 59.144'	0.5	12.16	16.69	7.81	9.32	277	ND (5.0) / ND (5.0)	ND (0.10)	2
-4M				4.0	12.05	16.60	7.82	9.31	430			
-4B				8.0	12.06	16.57	7.82	9.22	458			
F3-1S	1714	61° 12.348'	150° 01.284'	0.5	11.86	16.64	7.81	9.39	250/249	ND (5.0)	ND (0.10)	<2
-1M				4.0	11.86	16.71	7.81	9.32	258			
-1B				8.0	11.87	16.66	7.81	9.24	274			
F3-2S	1722	61° 12.541'	150° 00.681'	0.5	11.94	16.67	7.80	9.43	279	ND (5.0)	ND (0.10)	6
-2M				6.0	11.96	16.65	7.80	9.38	294			
-2B				12.0	11.95	16.62	7.81	9.37	282			
F3-3S	1730	61° 12.671'	150° 00.047'	0.5	12.00	16.63	7.85	9.41	261	ND (5.0)	ND (0.10)	<2
-3M				7.5	11.84	16.76	7.85	9.42	316/304			
-3B				14.5	11.79	16.78	7.83	9.40	327			

**Table 15. Hydrographic and Water Quality Data, 17 and 18 June 2008. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
F3-4S	1750	61° 12.862'	149° 58.596'	0.5	12.07	16.41	7.85	9.41	134	ND (5.0)	ND (0.10)	2
-4M				8.0	11.69	16.84	7.84	9.43	299			
-4B				16.0	11.69	16.83	7.84	9.42	300			
<b>JUNE 18</b>												
C1-1S	1453	61° 13.952'	149° 59.126'	0.5	12.64	14.55	8.09	9.44	234	ND (5.0)	ND (0.10)	4
-1M				11.0	12.34	15.16	8.09	9.40	402			
-1B				22.0	12.28	15.36	8.06	9.36	469			
C1-2S	1512	61° 14.009'	149° 59.016'	0.5	12.54	14.78	8.08	9.36	222	ND (5.0)	ND (0.10)	<2
-2M				4.5	12.59	14.91	8.07	9.34	199			
-2B				9.0	12.61	14.99	8.07	9.31	234			
C1-3S	1545	61° 14.443'	149° 58.100'	0.5	12.54	14.96	8.08	9.33	263	ND (5.0)	ND (0.10)	2
-3M				1.5	12.52	14.96	8.07	9.33	274/292			
-3B				3.0	12.48	14.97	8.07	9.34	329			
C1-4S	1613	61° 14.778'	149° 57.590'	0.5	12.67	14.84	8.06	9.33	316	ND (5.0)	ND (0.10)	2
-4M				1.0	12.65	14.88	8.06	9.34	340			
-4B				1.5	12.65	14.89	8.06	9.32	340			
C2-1S	1634	61° 13.947'	149° 59.089'	0.5	12.46	14.58	8.05	9.39	139/137	ND (5.0)	ND (0.10)	<2
-1M				6.0	12.40	14.67	8.05	9.40	258			
-1B				12.0	12.39	14.70	8.05	9.38	230			
C2-2S(A)	1644	61° 14.361'	149° 57.838'	0.5	12.51	14.54	8.05	9.38	193	ND (5.0)	ND (0.10)	<2
-2S(B)	1644			0.5	12.51	14.55	8.05	9.39	198	ND (5.0)	ND (0.10)	<2
-2S(C)	1644			0.5	12.50	14.15	8.05	9.43	189	ND (5.0)	ND (0.10)	2
-2M				3.0	12.50	14.56	8.05	9.36	205			
-2B				6.0	12.50	14.54	8.05	9.36	206			

**Table 15. Hydrographic and Water Quality Data, 17 and 18 June 2008. (continued)**

Station Number	Time (ADT)	Latitude (North)	Longitude (West)	Depth (M)	Temp <sup>b</sup> (°C)	Salinity <sup>b</sup> (‰)	pH <sup>b</sup> (units)	D.O. <sup>b</sup> (mg/L)	Turbidity (NTU)	Color (units)	TRC (mg/L)	Fecal Coliform <sup>a</sup>
C2-3S	1659	61° 14.875'	149° 56.610'	0.5	12.61	14.71	8.03	9.34	206/208	ND (5.0)	ND (0.10)	<2
-3M				3.5	12.64	14.85	8.03	9.33	224			
-3B				6.5	12.66	14.93	8.03	9.31	232			
C2-4S	1714	61° 15.056'	149° 55.679'	0.5	12.61	14.72	8.04	9.35	209	ND (5.0)	ND (0.10)	<2
-4M				10.0	12.52	14.80	8.04	9.34	285			
-4B				20.0	12.14	14.89	8.04	9.35	477			
C3-1S(A)	1758	61° 13.950'	149° 59.092'	0.5	12.26	15.93	8.00	9.35	331	ND (5.0)	ND (0.10)	17
-1S(B)	1758			---	---	---	---	---	348	ND (5.0)		
-1S(C)	1758			---	---	---	---	---	328	ND (5.0)		
-1M				11.0	11.86	16.31	8.00	9.31	393			
-1B				22.0	11.81	16.28	8.00	9.24	430			
C3-2S	1806	61° 14.164'	149° 57.891'	0.5	12.06	16.07	7.99	9.36	283	ND (5.0)	ND (0.10)	2
-2M				5.5	12.00	16.19	7.99	9.36	345			
-2B				11.0	11.94	16.21	7.99	9.34	418			
C3-3S	1828	61° 15.094'	149° 54.922'	0.5	12.10	16.16	7.99	9.35	308	ND (5.0)	ND (0.10)	8
-3M				12.5	11.94	15.91	8.00	9.35	389/386			
-3B				25.0	11.93	15.89	8.01	9.34	389			
C3-4S	1840	61° 15.966'	149° 53.807'	0.5	12.42	14.31	7.99	9.46	368	ND (5.0)	ND (0.10)	2
-4M				20.0	11.98	15.82	7.98	9.35	402			
-4B				39.5	11.97	15.74	7.99	9.32	404			

<sup>a</sup> Fecal coliform reported as MPN/100 mL.

<sup>b</sup> Values from CTD for 0.5 m depth taken as close to surface as possible.

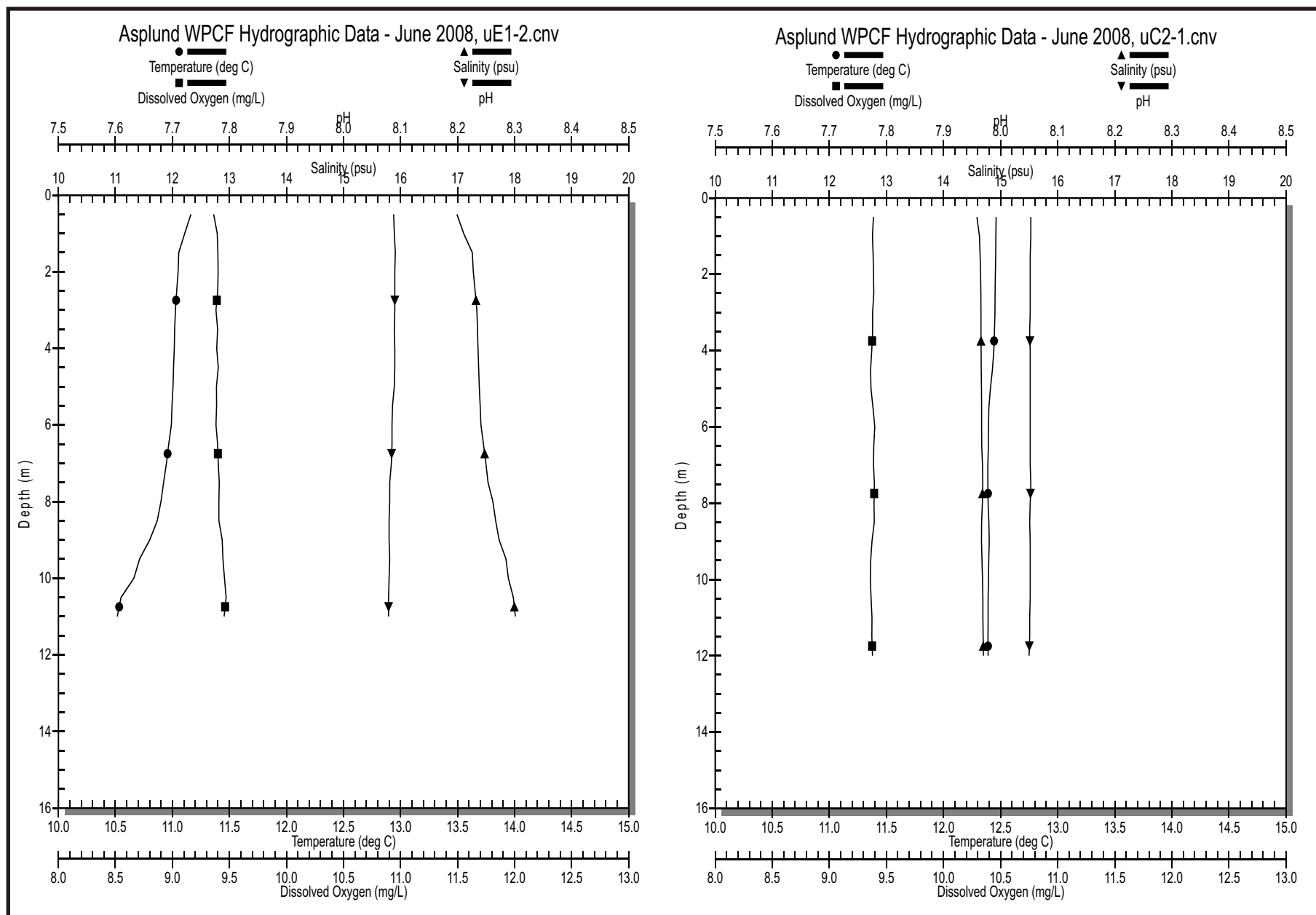
--- Samples not collected.

ND None detected (detection limit).

## Outfall Station

## Control Station

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**Figure 10. Sample Hydrographic Profiles from Outfall and Control Stations, June 2008.**

In addition to routine monitoring conducted at each water quality station, supplemental surface samples were collected at the first three stations (diffuser, ZID boundary, and nearfield) along the first flood drogue trajectory at both the outfall and control sites. A sample of final effluent was also obtained at the same time for comparison. Supplemental samples were analyzed for BETX, polycyclic aromatic hydrocarbons (PAHs), dissolved and total recoverable trace metals, cyanide, and TSS.

The maximum dissolved cadmium, mercury, lead, and silver concentrations were seen at Station F1-1 located at low slack water above the diffuser, within the ZID (Table 16). The highest dissolved arsenic and zinc concentrations were seen at Station F1-2 at the ZID boundary, while the highest dissolved chromium, copper, and nickel concentrations were seen at the control station, C1-1. The higher dissolved concentrations seen at Station F1-1 may be a discharge related effect; however, all dissolved metals concentrations met the AWQS as they were considerably less than the State of Alaska SSWQC for the Point Woronzof area.

Total metals concentrations were also quite variable and with the highest levels for all metals seen at the control site at Station C1-3 and the next highest levels seen at the other two control stations. These differences can be directly attributed to the high TSS levels seen at the control stations with the TSS level at Station C1-3 (410 mg/L) being twice as high as any of the three outfall locations where TSS concentrations ranged from 160 to 180 mg/L. The differences between the outfall and control sites could not be attributed to a discharge impact but were the result of natural differences in TSS concentrations. Total suspended solid results ranged from 220 to 410 mg/L at the control stations compared to 160 to 180 mg/L at the outfall stations. The effluent sample had a TSS concentration of 80 mg/L.

Cyanide concentrations were all found to be below the method detection limit of 1 µg/L at all receiving water stations including the control site stations. Estimated cyanide concentrations ranged from 0.10 to 0.21 µg/L. The AWQS of 1 µg/L was met for cyanide during the receiving water sampling. The cyanide concentrations in the effluent sample collected in conjunction with the receiving water sampling were 0.19 and 0.25 µg/L which are well below the MAEC of 181 µg/L.

Hydrocarbon analyses results are presented in Table 17. Total aromatic hydrocarbons (TAH) as BETX (EPA Method 602 samples from the concurrent summer dry sampling) was determined by summing benzene, ethylbenzene, toluene, and total xylenes. For values reported as ND, the reporting limit was used in the summation. Total aromatic hydrocarbons at the water quality stations were all ≤ 2.0 µg/L with the exception of Station F1-1 which had a concentration of 2.4 µg/L. Concentrations of TAH were below the receiving water standard of 10 µg/L at all stations, including both outfall and control stations. The effluent sample had a TAH concentration of 10.3 µg/L, similar to that seen in 2007 and significantly less than the MAEC of 1,810 µg/L.

All concentrations of individual PAHs were summed and reported as total PAHs (TPAH) in Table 17. TPAH concentrations were very similar between the control and outfall sites. The TPAH values ranged from 0.070 to 0.088 µg/L at the control stations and from 0.071 to 0.083 µg/L at the outfall stations. The TPAH concentration measured in the effluent sample was 3.88 µg/L. Total aqueous hydrocarbons (TAqH) as determined by the summation PAHs plus BETX were calculated for the six stations and effluent, with the contribution from BETX assumed to be 2 µg/L for those stations with all NDs (Table 17). Concentrations of TAqH were below the

**Table 16. Concentrations of Dissolved Metals, Total Recoverable Metals, Cyanide, and Total Suspended Solids in Receiving Water and Effluent Samples.** Values have not been blank corrected.

Station	Arsenic	Cadmium	Cyanide	Chromium	Copper	Mercury	Nickel	Lead	Silver	Zinc	TSS
	µg/L					ng/L	µg/L				mg/L
Dissolved Metals											
F1-1S (WITHIN ZID) <sup>a</sup>	1.54 / 1.55	0.106	NA	0.144	1.18	1.17	1.23	0.0125	0.0107	0.555	NA
F1-2S (ZID BOUNDARY)	1.56	0.0919	NA	0.116	1.23	0.434	1.16	0.008 U	0.00477	0.793	NA
F1-3S (NEAR FIELD)	1.53	0.0908	NA	0.115	1.08	0.511	1.15	0.008 U	0.00655	0.537	NA
C1-1S (CONTROL) <sup>a</sup>	1.48 / 1.55	0.0991 / 0.0860	NA	0.148 / 0.115	1.25 / 1.11	0.443	1.27 / 1.13	0.008U / 0.008U	0.00956 / 0.00287	0.694 / 0.559	NA
C1-2S (CONTROL)	1.47	0.0759	NA	0.090 U	0.839	0.476	0.917	0.008 U	0.002 U	0.252	NA
C1-3S (CONTROL)	1.53	0.0926	NA	0.115	1.16	0.463	1.18	0.008 U	0.00552	0.349	NA
EFFLUENT	1.61	0.135	NA	0.855	25.0	4.13	3.53	0.269	0.0196	52.7	NA
DETECTION LIMIT	0.021	0.008	NA	0.090	0.100	0.15	0.071	0.008	0.002	0.100	NA
Total Metals											
F1-1S (WITHIN ZID) <sup>a</sup>	5.01	0.121	0.16	5.16	8.37	12.0 / 12.7	6.07	2.33	0.0345	19.6	160
F1-2S (ZID BOUNDARY)	5.61	0.128	0.13 J	5.75	9.67	14.5	6.86	2.78	0.0390	22.6	180
F1-3S (NEAR FIELD)	6.11	0.127	0.21 J	6.01	9.87	16.2	7.08	3.00	0.0404	23.3	180
C1-1S (CONTROL)	6.96	0.128	0.10 J	7.11	11.2	19.2	8.05	3.77	0.0494	28.2	220
C1-2S (CONTROL) <sup>b</sup>	7.57	0.140	ND / 0.15J	7.48	11.9	20.6	8.38	4.09	0.0509	29.7	280 / 270
C1-3S (CONTROL)	13.0	0.169	0.13 J	9.87	18.5	79.5	11.8	7.21	0.112	42.6	410
EFFLUENT <sup>a</sup>	2.01	0.308	9.0J / 0.19J / 0.25J	7.88	35.6	65.6	4.21	2.17	1.14	111	80
DETECTION LIMIT	0.021	0.008	1.0	0.090	0.100	0.15	0.071	0.008	0.002	0.100	4.0

<sup>a</sup> Field sample value/lab duplicate value (where applicable)

<sup>b</sup> Field sample value/field duplicate value (where applicable)

NA Not analyzed. J Estimated value. U Not detected at or above the detection limit.



**Table 17. Supplemental Receiving Water and Effluent Hydrocarbon Analyses.**

PARAMETER	CONTROL FLOOD SAMPLES			ZID FLOOD SAMPLES			EFFLUENT
	C1-1S	C1-2S	C1-3S	F1-1S	F1-2S <sup>a</sup>	F1-3S	
<b>Volatile Organics (EPA 602) in µg/L with reporting limit in parenthesis if ND</b>							
Benzene	NA	ND (0.5)	0.47 J	ND (0.5)	ND (0.5)/(0.5)	ND (0.5)	ND (0.5)
Toluene	NA	0.53	0.82	1.0	ND (0.5)/(0.5)	0.39 J	6.4
Ethylbenzene	NA	ND (0.5)	0.23 J,Col	ND (0.5)	ND (0.5)/(0.5)	0.26 J,Col	0.86
Xylenes (Total)	NA	0.29 J	ND (0.5)	0.45 J	ND (0.5)/(0.5)	ND (0.5)	2.5 Col
TAH (as BETX)	NA	1.8	2.0	2.4	2.0 / 2.0	1.6	10.3
<b>Polynuclear Aromatic Hydrocarbons (PAH) by GC/MS in µg/L</b>							
TPAH	0.0718	0.0883	0.0703	0.0712	0.0818	0.0829	3.88
<b>Total Aqueous Hydrocarbons (TAqH) in µg/L</b>							
TAqH <sup>b</sup>	NA	1.9	2.1	2.5	2.1/2.1	1.7	14.18

<sup>a</sup> Duplicate field sample analysis provided (value/duplicate value)

<sup>b</sup> Defined by the State of Alaska as BETX analytes plus PAH analytes from EPA Method 610 analysis; these calculated values include the full suite of PAH analyte values measured by GERG not just analyte values from EPA method 610

ND None detected NA Not available, sample contaminated. J Estimated value. Result is less than reporting limits.

Col more than 40% difference between primary and confirmatory columns results. The lower of the two results is reported.

receiving water standard of 15 µg/L at all stations, including both outfall and control stations. Control stations ranged in TAqH from 1.9 to 2.1 µg/L, while outfall station TAqH concentrations ranged from 1.7 to 2.5 µg/L. The concentration of TAqH in the effluent was estimated at 14.18 µg/L, compared to the MAEC of 2,715 µg/L.

### 3.2.2 Intertidal Zone and Stream Bacterial Sampling

Intertidal zone and stream bacteriological sampling was performed on 17 June 2008 (Table 18). Refer to Figure 3 for a map of the intertidal station locations. Intertidal sampling began approximately 1 hour prior to high tide at 18:05 ADT and was completed at 19:00 ADT. Two replicates were taken at all intertidal stations. Stream sampling was conducted from 16:38 to 17:15 ADT on 17 June 2008. In addition, an effluent sample was collected at the plant at 12:06 ADT on this date.

Fecal coliform concentrations in the intertidal were very low this year and ranged from <2.0 to 2 FC MPN/100 mL. The highest fecal concentrations (2 FC MPN/100 mL) were seen at the second replicate at Station IT-3, 750 m east of the diffuser, and the second replicate at Station IT-5, 250 m southwest of the diffuser. Fecal coliform concentrations found in Fish, Chester, and Ship Creeks were lower than those seen in 2006 and similar to that seen in 2007, ranging from <2 FC MPN/100 mL in the second replicate at Chester Creek to 23 FC MPN/100 in the second replicate collected from Ship Creek. The replicate plant effluent samples taken on the same day showed fecal concentrations of 4 and 6 FC MPN/100 mL.

**Table 18. Summary of Bacterial Analyses, 17 June 2008.**

<b>Station and Replicate</b>	<b>Sample Time (ADT)</b>	<b>Fecal Coliform MPN/100 mL</b>
IT-1 Replicate 1	1900	<2
IT-1 Replicate 2	1900	<2
IT-2 Replicate 1	1857	<2
IT-2 Replicate 2	1857	<2
IT-3 Replicate 1	1856	<2
IT-3 Replicate 2	1856	2
IT-4 Replicate 1	1852	<2
IT-4 Replicate 2	1852	<2
IT-5 Replicate 1	1850	<2
IT-5 Replicate 2	1850	2
IT-6 Replicate 1	1848	<2
IT-6 Replicate 2	1848	<2
IT-7 Replicate 1	1842	<2
IT-7 Replicate 2	1842	<2
IT-C Replicate 1	1805	<2
IT-C Replicate 2	1805	<2
Plant Effluent Rep. 1	1206	4
Plant Effluent Rep. 2	1206	6
Fish Creek Rep. 1	1700	4
Fish Creek Rep. 2	1700	13
Chester Creek Rep.1	1715	7
Chester Creek Rep.2	1715	<2
Ship Creek Rep. 1	1638	9
Ship Creek Rep. 2	1638	23

## **4.0 QUALITY ASSURANCE/QUALITY CONTROL**

### **4.1 OBJECTIVES**

The program includes a comprehensive quality assurance/quality control (QA/QC) program that encompasses all aspects of the project, from initial sample collection and field observation recording through laboratory analysis and data analysis to reporting. The objectives of the QA/QC program were to fully document the field and laboratory data collected, to maintain and document data quality, and to ensure that the data collected are of sufficient quality to be comparable with data collected through other EPA-regulated NPDES programs. The program was designed to allow the data to be assessed by the following parameters:

- Precision
- Accuracy
- Comparability
- Representativeness
- Completeness.

These parameters were controlled by adhering to documented methods and procedures, by the analysis of quality control (QC) samples on a routine basis, through the use of laboratories with existing QA/QC plans, through data review and verification procedures, and through a comprehensive sample documentation program. Throughout the program, KLI coordinated with the subcontracting laboratories to ensure that their in-house QA/QC programs were being implemented to meet the required standards.

Quality control activities in the field included adherence to documented procedures, including those in the program workplan, and the comprehensive documentation of sample collection and sample identification information. Sample integrity and identification were ensured by a rigidly-enforced chain of custody program. The chain of custody procedure documents the handling of each sample from the time the sample was collected to the arrival of the sample at the laboratory.

Analytical methods in use on the program have been approved and documented by EPA. These methods were used as project-specific protocols to document and guide analytical procedures. Adherence to these documented procedures ensures that analytical results are properly obtained and reported.

### **4.2 FIELD QUALITY CONTROL**

Quality control activities in the field consisted of the following:

- adherence to documented procedures in the workplan
- cross-checking of field identifications, measurements, and recording to ensure consistency and accuracy
- comprehensive documentation of field observations, sample collection, and sample identification information.

Sampling procedures proposed for this project have been successfully used for a number of years on the Asplund WPCF monitoring program. The use of documented and well-known procedures

provides for greater likelihood of obtaining environmental samples uncontaminated by sampling procedures or apparatus. The use of project-specific field forms and data entry sheets also provide guidance for sampling procedures. Adherence to these procedures and use of these project documents helped ensure that data collected over the course of the project were comparable and accurate and that the study results are representative of conditions existing at the sampling sites.

#### **4.2.1 Documentation**

For observations made in the field, cross-checking between personnel was used as the primary method of quality control. These included, for example, review of navigational information recorded on the drogue field log. As described in Section 2.5, sample documentation began in the field using pre-printed log forms, labels, chain of custody (COC) forms, and pre-determined sample identification numbers that were designed specifically for use on this project. This extensive field documentation provided a paper trail that exists for each sample or field observation and ensures credibility of the data. All field records were reviewed by the field crew leader as soon as possible after sampling was completed. Completed field logs were filed at the KLI Anchorage office upon return from the survey.

Sample integrity and identification were ensured by the COC program. The chain of custody procedure documented the handling of a sample from the time the sample was collected to the arrival of the sample at the laboratory. At the time of shipment, the field personnel kept a copy of the completed chain of custody form, and the original accompanied the samples to the laboratory.

#### **4.2.2 Sample Handling**

Samples were frozen, chilled, and/or preserved as required by the appropriate methods in the field and until receipt at the laboratory. Samples were packed in coolers along with the completed COC forms for shipment to analytical facilities as described in Section 2.0. Coolers were securely packed with ice packs as required and sealed with signed and dated fiber tape for shipment.

#### **4.2.3 Navigation**

As described previously, navigation was accomplished with a DGPS system. The accuracy of the DGPS coordinates were verified by positioning the vessel over the diffuser during a low slack tide when the boil was evident and comparing DGPS readings with the known outfall location. Intertidal stations were re-occupied using a hand-held DGPS, distance and bearings, and visual sightings to temporary benchmarks and landmarks. All station information was entered on the appropriate field logs and reviewed by the field leader.

#### **4.2.4 Field Instrumentation**

Field equipment used for collection, measurement, and testing was subject to a strict program of control, calibration, adjustment, and maintenance. Care was taken to ensure that the instruments used for field measurements of temperature, salinity, DO, and pH were calibrated and adjusted with appropriate standards prior to and after each sampling event. The standards of calibration are in accordance with applicable criteria such as the U.S. Bureau of Standards, American

Society of Testing and Materials (ASTM) Standards, and follow the instrumentation manufacturer's recommended procedures.

Temperature calibration was ensured by pre-calibration at the factory and field checks of the electronic temperature sensor against a research grade thermometer reading taken from the same sample at the same time. The electronic sensor for salinity (conductivity) was also pre-calibrated at the factory and field checked against six ambient water samples which were collected for the analysis of salinity (SM 2520B) to verify the proper operation of the probe. The DO probe was also pre-calibrated at the factory. For pH, the electronic sensor probe was pre-calibrated using three known buffer solutions.

#### **4.2.5 Sampling Variability**

Sampling variability was documented by sampling three replicates at one station for the water quality parameters. This included three replicate Niskin<sup>®</sup> bottle casts to obtain replicate turbidity samples and three replicate grabs at the surface for fecal coliform, color, and TRC analyses. In addition, triplicate casts of the CTD for pH, DO, temperature, and salinity were performed at one station in order to check reading variability from the probe's electronic sensors.

#### **4.2.6 Field Check Samples**

Field check samples include trip blanks for volatile organic analyses for EPA Methods 602 and 624, field blanks, field generated duplicates, and standard reference materials (SRMs), spikes or other samples of known concentration that may be sent to the laboratory. With the exception of the trip blanks which are initiated at the laboratory, most of these samples were sent to the laboratory as blind samples to ensure unbiased reporting of results.

### **4.3 LABORATORY QUALITY CONTROL**

Analytical quality control for this project included the following:

- adherence to documented procedures, particularly EPA methods, internal laboratory protocols, and respective laboratory QA/QC programs
- calibration of analytical instruments
- ability of each analytical laboratory to meet analytical precision, accuracy, limits of detection, and limits of quantification that meet EPA requirements
- use of quality control samples, internal standards, and surrogate solutions

The analytical laboratories used on this project operate under the quality assurance (QA) programs described in their QA management plans. These programs involve the participation of qualified and trained personnel; the use of standard operating procedures for analytical methodology and procedures; a rigorous system of documenting and validating measurements; maintenance and calibration of instruments; and the analysis of quality control samples for precision and accuracy tracking. The pertinent methods descriptions the laboratories are following are comprehensive and provide information concerning proper sample collection, processing, storage, and preservation; required apparatus and materials; analytical procedure; standardization and calibration techniques; quality control samples required; methods of calculating values and assessing data quality; and reporting and performance criteria.

#### **4.3.1 Documentation**

Documentation in the laboratory included finalizing the original COC forms and generating the internal documents that track samples through the laboratory (e.g., sample control logs, refrigerator logs, etc.). Any deviations from the prescribed methods or internal laboratory standard operating procedures (SOPs) were documented in the project files. Data affected by such deviations were appropriately qualified, as was any data that did not meet acceptable quality criteria. Typical data qualifiers included those denoting estimated concentrations (J) or not detected (ND or U), and method blank contamination (B).

#### **4.3.2 Calibration**

Calibration is an integral part of any instrumental analysis. Calibration requirements for each type of analysis to be used on this project are described in the appropriate methods. Typically, instrument calibration was performed daily or on a per batch basis.

#### **4.3.3 Quality Control Procedures**

Internal laboratory quality control checks included the use of surrogate solutions and quality control samples such as procedural (or method) blanks, matrix spike/spike duplicates, standard reference materials (SRMs) or EPA QC check samples, and duplicates as specified in the EPA approved analytical procedures. Surrogate compounds were spiked into samples as appropriate to measure individual sample matrix effects that are associated with sample preparation and analysis. This included QC samples such as procedural blanks and matrix spike samples. Surrogate compound analyses were reported in percent recovery. Results from quality control samples allowed the assessment of quality assurance parameters such as accuracy and precision of the data. Any data falling outside the acceptable criteria as defined in the methods were appropriately investigated and qualified.

Method blanks are pure, organic- or metal-free reagent water that are run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect contamination. Method blanks were analyzed as called for by each method, typically one per day or one per sample batch.

Laboratory accuracy was assessed by routine spiking of environmental samples with a standard addition as called for by the appropriate method. Sample spikes and matrix spike/matrix spike duplicates were run on the organic analyses collected as part of both the in-Plant and receiving water monitoring components of the program. These samples were fortified with components of interest following the initial analysis to check the ability of the method to recover acceptable levels and to determine accuracy of the data. Quality control charts were prepared by the laboratories where applicable to show the range of individual measurements encountered by following procedures such as those outlined in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (EPA, 1982b) and other guidance documents (e.g. EPA, 1994a and 1994b).

Trace metals analyses for the monitoring were supported through the use of standard reference materials (SRMs), which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards and other sources. These SRMs were analyzed by the laboratory at the same time as the program samples in order to ensure laboratory

accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery.

Analytical and instrument variability was checked by laboratory splitting of one larger-volume field sample per survey into triplicates and analyzing the subsamples for the various water quality parameters. The individual measurements and concentration ranges were reported for each parameter of each split. In addition, duplicate analyses of samples split in the laboratory were used as a means to assess laboratory precision.

For other water quality parameters, the following summary of QA/QC procedures apply:

- Fecal Coliform Bacteria: *Escherichia coli* was used as a positive control for each analytical run. *Pseudomonas aeruginosa* was used as a negative control, and buffered dilution water was used as a blank. In addition, 10 % of the samples were run in duplicate.
- Enterococci Bacteria: *Streptococcus faecalis* was used as a positive control for each analytical run. *Escherichia coli* was used as a negative control, and buffered dilution water was used as a blank.
- Color: Fresh color standards were made prior to the beginning of the program. Samples were allowed to settle and decanted and either pre-treated with paper filtration or centrifuged to remove turbidity and reported as "true color".
- Turbidity: The instrument was calibrated with a 20.0 NTU standard provided by the manufacturer. Due to the high turbidity in Cook Inlet, all samples were run at the 10X scale on the nephelometer to ensure that the measured turbidities were within the range of the instrumentation. In addition, select samples were run in duplicate.
- Total Residual Chlorine: TRC was run by amperometric titration which requires a blank and laboratory control and laboratory control spike samples every ten samples. The amperometric titrant was standardized daily.
- Salinity: Sensor is factory calibrated at a minimum of once per year and field checked with either a refractometer or salinometer.

#### **4.3.4 Method Detection Limits**

Depending on each laboratory's adopted terminology, the method detection limits (MDLs), practical quantitation limits (PQLs), or method reporting limits (MRLs) for the various analytes were determined using the appropriate method as described in the protocols. These MDLs, PQLs, and MRLs were reported with the data (see appendices) and are included in summary data tables as appropriate. Concentrations below the PQL, or MRL were typically qualified with the "ND" code for non-detect or "J" when reported as an estimated value.

## **4.4 DATA REVIEW AND VALIDATION**

Data were verified by performing comparisons of final data against the original documentation, including the workplan, field logs and data sheets, and analytical reports. Any discrepancies were fully documented in the program files and reported in the annual report. Data were validated according to accuracy, precision, and completeness for both the field sample collection and analytical laboratory components of the program. Qualitative evaluation and statistical procedures were used to check the quality of the field and chemical data as appropriate. The primary goals of these review and validation procedures are to ensure that the data:

- are representative of conditions in the study area
- are accurate
- demonstrate the required level of precision
- are comparable with data from other NPDES programs
- are acceptable for use as a tool to evaluate permit compliance
- allow independent technical appraisal of the program's ability to meet the monitoring objectives.

Analytical data were subjected to review upon receipt from the laboratory following guidelines such as those published in *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994a), or *U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA 1994b). Items reviewed during data validation included sample holding times, results for laboratory method blanks, matrix spike/spike duplicates (MS/SD), check standards or SRMs, field and laboratory duplicates, field and trip blanks, report completeness, and laboratory performance (i.e., ability to achieve method detection limits and adherence to QA/QC criteria established for this program). Items failing to meet such validation and review procedures were noted and corrected, if possible. Items that could not be corrected and fell outside of acceptable limits (e.g., a sample analyzed outside holding time) have been noted in this annual report if they occur.

## **4.5 QUALITY ASSURANCE/QUALITY CONTROL RESULTS**

### **4.5.1 Field Instrumentation and Sampling Quality Control Results**

For influent, effluent, and sludge monitoring, field-generated duplicate influent and/or effluent samples were collected for the analysis of pesticides, cyanide, and enterococci bacteria during the June 2008 sampling. Results for these duplicate analyses are provided in Table 9 and the appendices, and were found to be within acceptance limits. Results from duplicate field samples collected for certain parameters during the receiving water sampling such as volatile organics, metals, cyanide, turbidity, and TSS are reported in the appropriate tables (Table 15, Table 16, and Table 17), and were found to be within acceptance limits.

Field blanks were collected for several parameters during each sampling event by pouring HPLC-grade deionized (DI) water into the appropriate sampling containers with the correct preservative. Trip blanks consisted of DI blank samples prepared at the laboratory that went through the same shipping and handling procedures as all the other sample containers of each analytical type; these remained unopened in the field. Field blanks and trip blanks analyzed using EPA Method 602 showed no measurable levels of the target compounds during the receiving water monitoring (Appendix C2). The trip blanks analyzed in conjunction with the



EPA 624 analyses for June 2008 showed trace levels of methylene chloride (Appendix A1). However, the field generated blanks analyzed in conjunction with the EPA 624 analyses for both June and August 2008 and the August 2008 trip blank showed non-detect levels of methylene chloride (Appendices A1 and B1). This compound was also detected in the influent and effluent for both sampling events and at trace levels below the reporting limit in the laboratory method blank for both June and August. Methylene chloride is a common laboratory contaminant that often shows up in both field samples and laboratory blanks. Values reported for these parameters are qualified with the "B" qualifier to indicate laboratory contamination (Table 9 and Table 10). Since this compound did not show up in the field-generated blind blanks for either June or August, this would indicate that the contaminant was introduced in the laboratory and not either in the field or in the Pt. Woronzof Plant.

Sampling variability for water quality parameters (fecal coliform, color, turbidity, and TRC) was determined by analyzing three discrete surface samples taken at Station C2-2S (Table 19). Where appropriate, the mean, standard deviation, and coefficient of variation are included in Table 19 to provide a measure of variability for parameters. The coefficient of variation for the various sample types was found to be 0 % for color, 0 % for TRC and 2.33 % for turbidity.

Three replicate fecal coliform samples were also collected at Station C2-2. Two of the three samples yielded the same result ( $<2$  FC MPN/100 mL) while the third yielded a result of 2 FC MPN/100 mL. Mean, standard deviation, and coefficient of variation are not determined for fecal coliform due to the nature of the analysis which yields only a most probable number of bacteria per 100 mL. Instead, the  $\pm 95$  % confidence limits for each sample are typically provided. Fecal coliform values were within the confidence limits.

Variability and calibration checks of the electronics probe were done by performing repeated profiles of temperature, pH, DO, and salinity at one station (C2-2). Results of these calibration checks for the Seabird CTD show that probe variability for temperature, pH, and DO was extremely low in all cases with a coefficient of variation of  $\leq 0.31$  % (Table 20). Probe variability for salinity was only slightly higher with a maximum coefficient of variation of  $\leq 1.58$  % that was seen at the surface with much lower variability seen at deeper depths in the water column. In addition, a precision thermometer was used to verify CTD temperature readings, and the pH and DO sensors were factory-calibrated prior to field deployment and the pH sensor was post-calibrated. The salinity, temperature, DO, and pH probes were found to be accurate and within calibration during the survey.

#### **4.5.2 Laboratory Quality Control Results**

Full analytical data and laboratory case narratives are provided for each laboratory in the appendices. Laboratory duplicate analyses, where performed, were found to have a high degree of precision and were within the acceptance criteria for relative percent difference (RPD). Laboratory duplicates were performed for a number of organic analyses and were found to be within acceptance limits. A number of duplicate confirmation results, however, did exceed QC criteria and have been appropriately qualified in their respective tables. One pesticide exceeded 40 % RPD between the primary and confirmation columns in the June 2008 sludge sample. During the August 2008 sampling event, two pesticides in the effluent and one in the sludge also exceeded RPD criteria. All data were appropriately qualified and full laboratory case narratives appear in Appendices A1 and B1.

**Table 19. Sampling and Laboratory Variability for Water Quality Samples, 17 and 18 June 2008.**

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
<b>SAMPLING VARIABILITY</b>					
C2-2S	A	<2 [---]	<5	193	<0.10
	B	<2 [---]	<5	198	<0.10
	C	2 [1.0-10]	<5	189	<0.10
Mean	---	---	<5	193	<0.10
Standard Deviation	---	---	0	4.5	0
Coefficient of Variation (%)	---	---	0	2.33	0
<b>LABORATORY VARIABILITY</b>					
C3-1S	A	17 [---]	<5	331	<0.10
	B	---	<5	348	NA
	C	---	<5	328	NA
Mean	---	---	<5	336	---
Standard Deviation	---	---	0	10.8	---
Coefficient of Variation (%)	---	---	0	4.9	---
E1-3S	A	NA	NA	67	NA
	B	NA	NA	61	NA
Relative % Difference	---	---	---	9.4	---
E2-1M	A	NA	NA	325	NA
	B	NA	NA	385	NA
Relative % Difference	---	---	---	16.9	---
E2-3S	A	NA	NA	NA	<0.10
	B	NA	NA	NA	<0.10
Relative % Difference	---	---	---	---	0
E2-3B	A	NA	NA	346	NA
	B	NA	NA	342	NA
Relative % Difference	---	---	---	1.2	---
E3-2S	A	NA	<5	371	NA
	B	NA	<5	379	NA
Relative % Difference	---	---	0	2.1	---
E3-4M	A	NA	NA	383	NA
	B	NA	NA	392	NA
Relative % Difference	---	---	---	2.3	---
F1-2B	A	NA	NA	195	NA
	B	NA	NA	194	NA
Relative % Difference	---	---	---	0.5	---
F2-4S	A	NA	<5	NA	<0.10
	B	NA	<5	NA	<0.10
Relative % Difference	---	---	0	---	0
F3-1S	A	NA	NA	250	NA
	B	NA	NA	249	NA
Relative % Difference	---	---	---	0.4	---

**Table 19. Sampling and Laboratory Variability for Water Quality Samples, 17 and 18 June 2008. (continued)**

Station	Subsample Designation	Fecal Coliform* (MPN/100 mL)	Color (units)	Turbidity (NTU)	TRC (mg/L)
F3-3M	A	NA	NA	316	NA
	B	NA	NA	304	NA
Relative % Difference	---	---	---	3.9	---
C1-3M	A	NA	NA	274	NA
	B	NA	NA	292	NA
Relative % Difference	---	---	---	6.4	---
C2-1S	A	NA	NA	139	NA
	B	NA	NA	137	NA
Relative % Difference	---	---	---	1.4	---
C2-3S	A	NA	NA	206	NA
	B	NA	NA	208	NA
Relative % Difference	---	---	---	1.0	---
C3-3M	A	NA	NA	389	NA
	B	NA	NA	386	NA
Relative % Difference	---	---	---	0.8	---

\* 95% confidence intervals indicated in brackets (American Public Health Association, 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. Washington, D.C. Table 9221.IV.)

NA Not analyzed

--- Not applicable

**Table 20. Seabird SEACAT SBE-19 CTD Probe Variability Check, 18 June 2008.**

Depth (m)	Temperature (°C)			Salinity (ppt)			pH (units)			DO (mg/l)			Mean (units)				Standard Deviation				Coeff. of Variation (%)			
C2-	2A	2B	2C	2A	2B	2C	2A	2B	2C	2A	2B	2C	Temp	Sal	pH	DO	Temp	Sal	pH	DO	Temp	Sal	pH	DO
0.5	12.51	12.51	12.50	14.54	14.55	14.15	8.05	8.05	8.05	9.38	9.39	9.43	12.51	14.41	8.05	9.40	0.005	0.228	0.001	0.029	0.04	1.58	0.01	0.31
1.0	12.51	12.51	12.50	14.54	14.54	14.55	8.05	8.05	8.05	9.38	9.38	9.42	12.51	14.55	8.05	9.39	0.005	0.007	0.001	0.021	0.04	0.05	0.01	0.22
1.5	12.50	12.51	12.50	14.55	14.54	14.56	8.05	8.05	8.05	9.37	9.39	9.42	12.51	14.55	8.05	9.39	0.007	0.010	0.002	0.029	0.05	0.07	0.03	0.31
2.0	12.50	12.51	12.50	14.55	14.54	14.56	8.05	8.05	8.05	9.36	9.41	9.41	12.50	14.55	8.05	9.39	0.005	0.011	0.001	0.029	0.04	0.07	0.01	0.31
2.5	12.50	12.50	12.50	14.55	14.55	14.56	8.05	8.05	8.05	9.37	9.42	9.40	12.50	14.55	8.05	9.39	0.003	0.007	0.000	0.026	0.02	0.05	0.00	0.28
3.0	12.50	12.50	12.50	14.56	14.56	14.56	8.05	8.05	8.05	9.36	9.40	9.41	12.50	14.56	8.05	9.39	0.001	0.004	0.001	0.026	0.01	0.03	0.01	0.28
3.5	12.50	12.50	12.50	14.56	14.56	14.56	8.05	8.04	8.04	9.36	9.38	9.41	12.50	14.56	8.05	9.38	0.000	0.003	0.002	0.028	0.00	0.02	0.02	0.29
4.0	12.50	12.50	12.50	14.56	14.55	14.56	8.05	8.04	8.04	9.36	9.38	9.40	12.50	14.56	8.04	9.38	0.001	0.003	0.002	0.021	0.01	0.02	0.03	0.22
4.5	12.50	12.50	12.50	14.56	14.55	14.56	8.05	8.05	8.05	9.37	9.38	9.39	12.50	14.55	8.05	9.38	0.001	0.005	0.000	0.008	0.01	0.03	0.00	0.09
5.0	12.50	12.50	12.50	14.55	14.54	14.55	8.05	8.04	8.05	9.37	9.36	9.39	12.50	14.55	8.04	9.37	0.002	0.006	0.002	0.015	0.01	0.04	0.02	0.16
5.5	12.50	12.50	12.50	14.55	14.54	14.55	8.05	8.05	8.05	9.36	9.36	9.39	12.50	14.55	8.05	9.37	0.001	0.005	0.002	0.014	0.01	0.03	0.02	0.15

In addition to the standard laboratory QC procedures, color and turbidity samples collected at Station C3-1 during the receiving water sampling were split in the laboratory and analyzed in triplicate. Mean, standard deviation, and coefficient of variation are reported in Table 19 for these samples. Coefficient of variation was shown to be 0 % for color and 4.9 % for turbidity. For analyses where samples were run in duplicate, such as TRC, turbidity, and color, the relative percent difference between duplicates was calculated. Laboratory duplicate analyses were found to generally be very low and within acceptable limits. Duplicate results for turbidity ranged from 0.4 to 16.9 % RPD. Color duplicate results showed 0 % difference between duplicates. Duplicate TRC analyses were all identical to the original sample results at <0.10 mg/L.

Laboratory accuracy was assessed through the use of surrogate recoveries, sample and control spikes and duplicates, and SRMs. Detailed QA/QC results for all contract laboratory analyses are provided in the appendices corresponding to each analysis. Surrogates are compounds that were added to each sample and QC sample that were analyzed by GC methodology, such as volatile organic compounds (EPA 602 and 624/8260B), semi-volatile organic compounds (EPA 625/8270C), pesticides (EPA 608/8081A/8082 and 614/8141A), and dioxins (EPA 8280A). Several instances of surrogate recoveries outside QC recovery limits were found during the 2008 influent, effluent, and sludge monitoring effort. These deviations are discussed in the case narratives that were provided by each laboratory which fully detail all QC issues for both sampling events and explain any QC deviations; these are provided in the appendices. As indicated by the laboratories, the data were not significantly affected by any QC issue.

Matrix spike (MS), matrix spike duplicate (MSD), laboratory control spike (LCS), and duplicate control spike (DCS) are samples and blanks that are spiked with target compounds of interest to determine percent recovery and relative percent difference between duplicates. The QC criteria include an acceptable recovery range and an RPD that should not be exceeded. Total metals, dissolved metals, cyanide, volatile organic compounds, and semi-volatile organic compounds met QC criteria for MS, MSD, LCS, and DSC with a few exceptions for all analyses on the program. Detailed case narratives were provided by each laboratory which fully detail all QC issues for both sampling events and explain any QC deviations; these are provided in Appendices A1, A2, B1, B2, C1, C2, C3, and C4.

Trace metals analyses for the influent, effluent, sludge, and receiving water testing were supported through the use of SRMs, which are quality control reference materials with known metals values that are obtained from the National Bureau of Standards, National Institute of Standards and Technology, or other certified standards. These SRMs were analyzed by the laboratories at the same time as the project samples in order to ensure laboratory accuracy. Results of the analyses of SRMs should fall within acceptable limits and can be expressed as percent recovery. Except for silver in one of the seawater SRMs run in association with the receiving water program, all metals SRM results were within acceptance limits (Appendix C4). The SRM results for silver were within acceptable ranges when blank-corrected. These recovery problems were not seen in the other SRM analysis performed for these metals, and data quality was not judged to be adversely affected as other QC checks for these samples were found to be acceptable and no further corrective action was taken.

Method blanks (or procedural blanks) were also analyzed for most analyses on the program. Method blanks consist of pure, organic- or metal-free reagent grade water that is run through the analysis process and used to verify that analyte concentrations are accurate and do not reflect

contamination. With the exception of a number of trace level metals analyses that were conducted as part of the influent, effluent, and sludge program, methylene chloride and bis (2-ethylhexyl) phthalate seen in the June and August 2008 organic analyses, oil and grease in the August analyses, and dichlorobenzene seen in the sludge analyses, all method blank results for the program showed no contamination during 2008. Total chromium and molybdenum were detected in the June influent and effluent blank, chromium and zinc were seen in the August blank, and the sludge blank showed trace levels of chromium, copper, and zinc in June and selenium in August. Without exception, the levels that were detected in the method blanks were at trace estimated values that were below the reporting limits and appropriately qualified with both a “B” and a “J”. Concentrations in the corresponding influent or effluent sample were either low or estimated values below the method reporting limit and did not adversely affect the results. A detailed case narrative for these samples provided by the laboratory which fully details all QC issues is provided in Appendix A1 and B1.

During the receiving water program, copper and zinc were detected at very low levels in the method blank in the ultra-low level metals analyses that were performed by Battelle. Metals concentrations seen in the receiving water were 1-2 orders of magnitude higher than that seen in the method blank and all other QC criteria were within acceptance limits, therefore no further action was taken.

The method blank analyses performed with the TSS analyses showed no results above method detection limits. In addition to the typical method blanks, buffered dilution water was used as a blank for fecal coliform and enterococci bacteriological analyses. All blanks run for fecal coliform and enterococci showed no growth. In accordance with the laboratories QA/QC policy, all sample results less than twenty times the level found in the method blank were flagged as estimated concentrations.

## **5.0 DISCUSSION**

### **5.1 INFLUENT, EFFLUENT, AND SLUDGE MONITORING**

The NPDES permit for the Asplund WPCF requires compliance with applicable State water quality standards as promulgated in Chapter 70 of the Alaska Administrative Code entitled "Water Quality Standards" (18 AAC 70; ADEC, 1999). This chapter requires that criteria outlined in "EPA Quality Criteria for Water" (also known as "The Red Book"; EPA, 1976), the revised quality criteria for water (EPA 1986b), and other applicable criteria as referenced in the AWQS be met in applicable receiving waters at every point outside of the ZID boundary. Also, as noted in Section 1.1.1, the State of Alaska water quality regulations include SSWQC for the Point Woronzof area of Cook Inlet for turbidity and the dissolved fraction of arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Since the issuance of the current permit, EPA has approved ADEC's proposed use of dissolved metals for all of the State's marine water quality criteria, approved all of ADEC's proposed SSWQC for Upper Cook Inlet, and removed Alaska from the National Toxics Rule list (EPA 2006; Sept. 15, 2006 letter to ADEC). Except for cadmium, where the dissolved standard changed from 9.3 to 8.8 µg/L, all other dissolved metals criteria are the same as those listed in the SSWQC. Even though EPA has approved the use of dissolved metals criteria for Alaska's marine water quality criteria, the current SSWQC will most likely remain in affect for the Point Woronzof area for permit renewal. Therefore, we have used both the SSWQC and the more restrictive criteria for dissolved cadmium to evaluate the data in this report. For other parameters such as TRC we have utilized the current AWQS (ADEC 2003), since those criteria will be utilized for the permit renewal process. Finally, the permit itself includes some effluent limitations that must be met. The following sections discuss the parameters of concern in regards to the requirements of the NPDES permit or the AWQS as well as historical data from the WPCF, data from other publicly-owned treatment works (POTWs), or other EPA data.

#### **5.1.1 Influent and Effluent Monitoring**

Table 21 lists permit effluent limitations and water quality criteria that are applicable to the current NPDES permit; it includes each of the parameters required to be monitored by the permit. Most of the values shown are the chronic toxicity criteria for salt water aquatic life. Chronic toxicity criteria concentrations are lower than acute toxicity criteria concentrations; therefore, the more stringent of the two values were used here for comparison. The MAEC for each constituent was calculated from the outfall design dilution factor of 142:1 (for conservative substances) or 180:1 (for non-conservative substances), the water quality criteria, and the natural background concentrations as determined historically at the control site near Point MacKenzie. It was assumed that the final effluent would be diluted by a minimum factor of 142 by the time it reached the boundary of the ZID. For most metals, the MAECs were calculated from the SSWQC for dissolved metals contained in the AWQS for the Point Woronzof area.

To determine compliance with State water quality standards, Table 21 can be compared with effluent values found in Table 8 through Table 11 as well as those in Table 16 and Table 17. The AWWU 2008 maximum effluent concentrations shown in Table 21 were the maximum encountered during the calendar year either during AWWU's in-plant monitoring, the toxic pollutant and pesticide monitoring events, pretreatment monitoring, or the supplemental effluent monitoring that was performed as part of the receiving water sampling. For metals, both total and dissolved concentrations in the effluent were compared against their MAEC, since it is

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2008 Maximum Concentrations for Effluent Comparisons.** Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2008 Maximum Effluent Concentration <sup>c</sup>
Antimony (µg/L)	146	Human health, not listed for saltwater aquatic life	20,607	0.57 J <sup>d,e</sup>
Arsenic (µg/L)	36	Chronic toxicity, measured as dissolved	4,882	2.8 J <sup>e</sup>
Beryllium (µg/L)	11	For the protection of aquatic life in soft fresh water	1,513	ND (1.0) <sup>d,e</sup>
Cadmium (µg/L)	9.3 (8.8) <sup>k</sup>	Chronic toxicity, measured as dissolved	1,322 (1,250)	4.9 <sup>e</sup>
Chromium (VI) <sup>h</sup> (µg/L)	50	Chronic toxicity, measured as dissolved	7,038	7.88 <sup>f</sup>
Copper (µg/L)	3.1	Chronic toxicity, measured as dissolved	317	41 <sup>e</sup>
Lead (µg/L)	8.1	Chronic toxicity, measured as dissolved	1,140	2.8 <sup>d,e</sup>
Mercury (µg/L)	0.025	Chronic toxicity, measured as dissolved	2.73	0.076 J <sup>e</sup>
Nickel (µg/L)	8.2	Chronic toxicity, measured as dissolved	978	4.21 <sup>f</sup>
Selenium (µg/L)	71	Chronic toxicity, measured as dissolved	10,136	2.5 J <sup>d,e</sup>
Silver (µg/L)	1.9	Acute toxicity, measured as dissolved	257	1.7 <sup>e</sup>
Thallium (µg/L)	2,130	Acute toxicity to saltwater aquatic life	306,567	ND (1.0) <sup>d,e</sup>
Zinc (µg/L)	81	Chronic toxicity, measured as dissolved	11,249	120 <sup>d,e</sup>



**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2007 Maximum Concentrations for Effluent Comparisons. (continued)**  
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>		Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2008 Maximum Effluent Concentration <sup>c</sup>
Cyanide (µg/L)	1	For marine aquatic life	181	9.0 J <sup>d,e,f</sup>
Total Aqueous Hydrocarbons (TAqH) (µg/L)	15	Growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers <sup>a</sup>	2,715	14.18 <sup>f</sup>
Total Aromatic Hydrocarbons as BETX (µg/L)	10	Same as above <sup>a</sup>	1,810	19.0 <sup>d</sup>
pH (pH units)		<i>g</i>	6.5 - 8.5	6.6 – 7.7 <sup>i</sup>
Total Residual Chlorine (TRC) (mg/L)		<i>g</i>	Daily Max. 1.2	Daily Max 0.90 <sup>i</sup>
BOD <sub>5</sub> (mg/L)		<i>g</i>	Monthly Avg. 240 Weekly Avg. 250 Daily Max. 300 Monthly Removal Rate ≥30 %	Monthly Avg. 149 <sup>i</sup> Weekly Avg. 177 <sup>i</sup> Daily Max. 200 <sup>i</sup> (Monthly Avg. Rate 31 – 44% <sup>i</sup> ) Annual Avg. Removal Rate (39% in 08) <sup>i</sup>

**Table 21. NPDES Requirements, State of Alaska Water Quality Standards, and AWWU 2007 Maximum Concentrations for Effluent Comparisons. (continued)**  
Non-compliant values are shown in **bold** type.

Parameter	Receiving Water Quality Standard <sup>a</sup>	Maximum Allowable Effluent Concentration <sup>b</sup> (MAEC)	AWWU 2008 Maximum Effluent Concentration <sup>c</sup>
Total Suspended Solids (TSS) (mg/L)	<i>g</i>	Monthly Avg. 170 Weekly Avg. 180 Daily Max. 190 Monthly Removal Rate ≥30%	Monthly Avg. 56 <sup>i</sup> Weekly Avg. 67 <sup>i</sup> Daily Max. 90 <sup>i</sup> Monthly Avg. Rate 73 – 80% <sup>i</sup> , Annual Avg. Removal Rate 77% <sup>i</sup>
Total Ammonia (mg/L)	9.8 <sup>j</sup>	1,774	Monthly Max. 22.5 <sup>i</sup>
Fecal Coliform (FC MPN/100 mL)	<i>g</i>	Monthly geometric mean of at least five samples shall not exceed 850.  Not more than 10% of samples shall exceed 2600.	Monthly mean maximum was 63 <sup>i</sup>  The criterion of not more than 10% of samples exceeding 2600 was met in 2008. <sup>i</sup>

*a* Alaska Administrative Code, 2003. Water Quality Standards, Chapter 70, 18 AAC 70.020(b)

*b* For conservative substances, effluent water quality criteria were determined by assuming a dilution of 142:1 at the ZID boundary, where: MAEC = 142 \* (Criteria - Natural Background Concentration) + Criteria; pollutant concentrations in the effluent should not exceed these values. For non-conservative substances, a dilution of 180:1 was utilized in the MAEC calculation.

*c* For metals, the maximum effluent concentration was determined from both total and dissolved concentrations.

*d* Values from June 2008 or August 2008 toxic pollutant and pesticide samplings.

*e* Values from AWWU's pretreatment program.

*f* Values from effluent tested during receiving water sampling event.

*g* MAECs are not based on water quality criteria but instead are specified in MOA's 2000 NPDES permit.

*h* All samples tested as total chromium.

*i* Values from AWWU's in-plant monitoring.

*j* Ammonia receiving water criteria based on pH of 8.0, temperature of 15.0°C, and salinity of 20psu.

*k* Cadmium standard based on revised EPA level that was approved for State of Alaska (2001).

assumed that all of the metals contained in the effluent are potentially bioavailable upon entering the receiving water. All effluent concentrations were found to be much lower than the MAECs from the permit or computed from the water quality standards provided for in the AWQS. In addition, the permit limitations for all parameters were met for the 2008 program year. When the MAECs in Table 21 were compared to AWWU's self-monitoring effluent data, the toxic pollutant and pesticides sampling events (June and August 2008), the pretreatment monitoring data, and the effluent data from the receiving water sampling, no metals or cyanide values exceeded their MAECs. The highest concentrations of either total or dissolved metals seen in 2008 were all well below their respective MAECs. The one metal that most closely approached its MAEC at any time was copper, and this was considerably below its MAEC. The maximum concentration of total copper was 41 µg/L compared to a MAEC of 317 µg/L. The highest dissolved copper concentration that was seen was 25 µg/L.

Those metals without SSWQC, while analyzed as both total and dissolved metals as called for by the permit, are compared to total recoverable metal MAECs as provided by EPA criteria and as called for by the AWQS. Total metals concentrations for antimony, beryllium, and thallium were generally low, often below detection limits, and all well below their MAECs. As in past years, total recoverable metals detected in the influent and final effluent were compared with data from an EPA study of 40 Publicly Owned Treatment Works (POTWs) in Table 22 (EPA, 1982a). Without exception, metals and cyanide values were lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants.

Historic influent and effluent total recoverable metals and cyanide concentrations collected as part of AWWU's self-monitoring program are presented in Table 23 and Table 24. It should be noted that prior to 2000 when the permit requirements changed, dissolved metals had only been analyzed in a single sample of effluent collected each year during the receiving water sampling. Beginning in August 2000, dissolved metals from the effluent have been analyzed in both the summer wet and summer dry sampling events and as part of the pretreatment monitoring. Concentrations are low and fairly consistent over time. Concentrations of total recoverable metals concentrations seen in the influent and effluent during 2008 generally fell within the range of concentrations seen during prior years. Concentrations of dissolved metals were generally found to fall within range of concentrations seen over the prior five years as seen in Table 23. In 2008, cyanide concentrations were typical of the long term average whereas in 2007 cyanide appeared to be slightly elevated although still within the historic range.

During the 1980s, total copper levels would sometimes exceed the previous permit's MAEC of 100 µg/L. While this permit limit is no longer in effect, it is interesting to note that the maximum total copper concentration encountered in the effluent during the year 2008 (from the pretreatment monitoring) was considerably lower at 41 µg/L. The reasons for the elevated copper concentrations in previous years were investigated and reported to the Municipality by CH2M Hill and the AWWU laboratory. The conclusion of the copper investigation was that most of the copper in the influent is from the leaching of copper from residential plumbing rather than industrial discharge (CH2M Hill, 1987; CH2M Hill et al., 1988). Neither enforcement of the sewer ordinance (AMC 26.50) nor the industrial pretreatment program was expected to significantly reduce the amounts of copper received at the Asplund WPCF. The mass of copper in the plant influent and effluent remained fairly constant from 1986 through 1991. From 1991 to 1992, the in-plant copper loading dropped by approximately 25 %. The exact cause of this

**Table 22. Comparison Between Influent/Effluent Analysis Results for Anchorage and 40 POTWs.<sup>a</sup>**

Parameter	Anchorage Values				40 POTW Study Values				
	2008 Concentration <sup>b,c</sup> (µg/L)				Frequency of Detection (%)		Range Detected (µg/L)		Influent Median
	Summer-Dry		Summer-Wet		Influent	Secondary Effluent	Influent	Secondary Effluent	(µg/L)
	INF	EFF	INF	EFF					
VOLATILES <sup>d</sup>									
Benzene	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	61	23	1-1560	1-72	2
Chloroform	2.3 J	3.0 J	2.2 J	3.0 J	91	82	1-430	1-87	7
1,4 Dichlorobenzene	ND (5.0)	ND (5.0)	0.92 J	0.96 J	17	3	2-200	3-9	NA
Ethylbenzene	1.6 J	0.76 J	ND (5.0)	ND (5.0)	80	24	1-730	1-49	8
Methylene chloride	5.3 B	3.4 J,B	6.1 B	7.7 B	92	86	1-49000	1-62000	38
Tetrachloroethene	1.8 J	0.94 J	0.92 J	ND (5.0)	95	79	1-5700	1-1200	23
Toluene	11	6.8	4.5 J	6.4	96	53	1-13000	1-1100	27
Xylene (Total)	9.1 J	4.5 J	2.1 J	2.6 J	NA	NA	NA	NA	NA
SEMI-VOLATILES <sup>d</sup>									
Bis(2-ethylhexyl)phthalate	37 J,B	33 J,B	26 J	14 J	92	84	2-670	1-370	27
Diethyl phthalate	7.7 J	7.7 J	8.1 J	7.8 J	53	13	1-42	1-7	3
Phenol	33 J	23 J	30 J	25 J	79	29	1-1400	1-89	7
TOTAL METALS & OTHER COMPONENTS									
Antimony	1.1 J	0.57 J	0.48 J	0.47 J	14	13	1-192	1-69	NA
Arsenic	3.2 J	2.5 J	2.1 J	2.2 J	15	12	2-80	1-72	NA
Beryllium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	3	1	1-4	1-12	NA
Cadmium	0.67 J	0.51 J	6.8	0.60 J	56	28	1-1800	2-82	3
Chromium	8.0 B	2.3 B, J	3.9 B	2.2 B, J	95	85	8-2380	2-759	105
Copper	92	36	60	37	100	91	7-2300	3-255	132
Lead	13	2.8	4.0	2.3	62	21	16-2540	20-217	53
Mercury	0.14 J	0.047 J	0.11 J	0.041 J	70	31	0.2-4	0.2-1.2	0.517
Molybdenum	9.8 B	6.4 B	4.5	4.5	NA	NA	NA	NA	NA
Nickel	6.5	2.5	4.4	3.2	79	75	5-5970	7-679	54
Selenium	1.3 J	1.3 J	1.6 J	ND (5.0)	9	10	1-10	1-150	NA
Silver	3.2	1.3	1.8	1.4	71	25	2-320	1-30	8
Thallium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	3	2	1-19	1-2	NA
Zinc	290	120	170 B	110 B	100	94	22-9250	18-3150	273
Cyanide	2.5 J	9.0 J (0.19/0.25)	ND (10)	6.9 J	100	97	3-7580	2-2140	249

<sup>a</sup> Source: EPA, 1982. *Fate of Priority Pollutants in POTWs*. Final Report, Volume I, Effluent Guidelines Division, WH-552, EPA 440/1-82/303

<sup>b</sup> Data from NPDES 2008 toxic pollutant and pesticide monitoring

<sup>c</sup> Duplicate analyses for CN collected during receiving water

<sup>d</sup> Only analytes detected in either the influent or effluent are included

B Also detected in associated method blank

J Estimated value

NA Not available

ND Not detected

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years.** Values in brackets are from EPA Method 602 where available.

Pollutant	2003		2004		2005	
	Dry <sup>b</sup>	Wet <sup>b</sup>	Dry	Wet	Dry	Wet
	6/25-26	8/12-13	6/23-24	8/23-24	5/23-24	8/1-2
<b>ORGANICS (µg/L)</b>						
Benzene	ND[ND/ND]	ND[ND/ND]	ND[0.24 J]	ND	ND [ND]	3.3 J
Bis-(2-ethylhexyl) phthalate	18 B	13	16	15	15	14 B
Bromomethane	7.0 J	ND	ND	ND	ND	ND
Butyl benzyl phthalate	3.0 J	ND	ND	4.2 J	7.4 J	2.7 J
Chloroform	3.8 J	3.2 J	3.2 J	3.6 J	2.6 J	4.1 J
Chloromethane	ND	ND	ND	ND	ND	1.4 J
*1,3-Dichlorobenzene	ND[ND/ND]	ND[ND/ND]	ND	ND	ND	ND
*1,4-Dichlorobenzene	ND[ND/ND]	ND[1.2/1.2]	ND	ND	ND	ND
Diethyl phthalate	7.3 J	11	NDND8.5 J	7.4 J	8.5 J	10
Di-n-butyl phthalate	1.6 J	ND	1.7 J	ND	ND	ND
Ethylbenzene	ND[1.8/1.1]	ND[1.1/1.3]	ND[0.37J,COL]	ND	ND(ND)	ND
Methylene Chloride	4.1 J	2.9J	4.4 J	4.7 J,B	2.6 J,B	5.0 B
Phenol	18	23	19	19	19	21
Tetrachloroethene	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND
Toluene	7.4[5.8/6.4]	5.3[9.0/9.6]	5.9[6.4]	7.2	4.0 J [5.6]	10
* Total Xylenes	5.1 J[6.9/8.3]	ND[14/15]	ND[1.3COL]	ND	1.5 J [0.93]	2.4 J
Total Hydrocarbons as Oil and Grease <sup>a</sup>	24000	20100	26300	25400	21400	17600
Total Aromatic Hydrocarbons as BETX	22.5[15.2/14]	25.3[24.6/26.4]	25.9[8.31]	27.2	1.5 J [0.93]	20.7
<b>OTHER</b>						
Cyanide (µg/L)	ND	ND	ND	ND	ND	ND
Asbestos (million fibers/L)	ND	ND	ND	ND	ND	ND

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602 where available.

Pollutant	2006		2007		2008	
	Dry	Wet	Dry	Wet	Dry	Wet
	6/27-28	8/15-16	6/19-20	8/7-8	6/17-18	8/13-14
<b>ORGANICS (µg/L)</b>						
Benzene	ND [0.43J]	0.59 J	0.58 J[ND]	0.27 J	ND[ND]	ND
Bis-(2-ethylhexyl) phthalate	18	10	20 J	0.20 J	33 J,B	14 J
Bromomethane	ND	ND	ND	ND	ND	ND
Butyl benzyl phthalate	ND	ND	ND	ND	ND	ND
Chloroform	3.6 J	3.8 J	3.4 J	3.8 J	3.0 J	3.0 J
Chloromethane	ND	1.1 J	ND	1.7 J	ND	ND
* 1,3-Dichlorobenzene	ND	ND	9.5	ND	ND	ND
* 1,4-Dichlorobenzene	1.0 J	1.1 J	9.5	0.98 J	ND	0.96 J
Diethyl phthalate	7.7 J	7.9 J	10 J	ND	7.7 J	7.8 J
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND [3.8]	0.62 J	2.9 J[ND]	0.62 J	0.76 J [0.86]	ND
Methylene Chloride	4.5 J	3.3 J,B	3.1 J	3.5 J, B	3.4 J, B	7.7 B
Phenol	18	13	24 J	25 J	23 J	25 J
Tetrachloroethene	4.0 J	1.4 J	6.4	2.5 J	0.94 J	ND
1,1,2,2-Tetrachloroethane	ND	ND	3.3 J	ND	ND	ND
Toluene	8.7 [11]	8.7	21[4.9]	8.1	6.8[6.4]	6.4
* Total Xylenes	6.7 J [17]	3.1 J	23 [2.6]	3.1 J	4.5 J [2.5 COL]	2.6 J
Total Hydrocarbons as Oil and Grease <sup>a</sup>	19900	19400	14900	34500	28000	32000 B
Total Aromatic Hydrocarbons as BETX	25.4 [32.23]	13.0	47.5 [8.5]	12.1	17.1	19.0
<b>OTHER</b>						
Cyanide (µg/L)	5	ND	9J/9J/10	59	9.0 J (0.19 / 0.25)	6.9 J
Asbestos (million fibers/L)	ND	ND	ND	ND	ND	ND

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602 where available.

Pollutant	2003		2004		2005	
	Dry	Wet <sup>b</sup>	Dry	Wet <sup>b</sup>	Dry	Wet <sup>b</sup>
	6/25-26	8/12-13	6/23-24	8/23-24	5/23-24	8/1-2
<b>TOTAL METALS (µg/L)</b>						
Antimony	ND	ND/ND	ND	ND/ND	0.65	ND/ND
Arsenic	3	5	ND	ND	3	2
Beryllium	ND	0.07	0.2	0.1	0.1	ND
Cadmium	ND	0.7	ND	ND	0.3	ND
Chromium	7	2	4	ND	5	3
Copper	60	49	63	65	52	54
Lead	7	2	12	4	6	2
Mercury	0.13	0.1	0.11	0.70	0.10	0.11
Molybdenum	NT	NT	NT	NT	NT	NT
Nickel	1	5	5	ND	4	4
Selenium	ND	ND/ND	ND	ND/ND	0.47	ND/ND
Silver	3.3	2.8	3.9	ND	1.7	1.4
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	70	69	140	76	90	90
<b>DISSOLVED METALS (µg/L)</b>						
Antimony	ND	ND/ND	ND	ND/ND	0.45	ND/ND
Arsenic	ND	4	ND	ND	2	2
Beryllium	ND	ND	ND	0.1	0.1	ND
Cadmium	ND	0.9	0.6	ND	ND	ND
Chromium	ND	1	ND	ND	4	2
Copper	27	39	27	49	37	42
Lead	7	ND	4	8	6	2
Mercury	0.05	ND	ND	ND	ND	ND
Molybdenum	NT	NT	NT	NT	NT	NT
Nickel	3	3	6	ND	ND	ND
Selenium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Silver	0.6	ND	ND	0.6	ND	0.9
Thallium	ND	ND/ND	ND	ND/ND	ND	ND/ND
Zinc	30	69	40	12	40	40
<b>PESTICIDES (µg/L)</b>						
alpha-BHC	ND	ND	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND	ND	0.037 J
Dieldrin	ND	ND	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND	0.075 J	ND
Endrin	ND	ND	ND	ND	ND	ND
Endrin ketone	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	0.17 J	0.99
4,4'-DDD	ND	ND	ND	ND	ND	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND
Malathion	031	ND	ND	ND	0.49 J, CHI	ND

**Table 23. Comparison of Toxic Pollutants and Pesticides in Anchorage's Final Effluent to the Previous Five Years. (continued)** Values in brackets are from EPA Method 602 where available.

Pollutant	2006		2007		2008	
	Dry	Wet	Dry	Wet	Dry	Wet
	6/27-28	8/15-16	6/19-20	8/7-8	6/17-18	8/13-14
<b>TOTAL METALS (µg/L)</b>						
Antimony	0.65	0.58/0.60	ND	ND	0.57 J	0.47 J
Arsenic	2.4	2.6/2.8	2.18	1.83	2.5 J	2.2 J
Beryllium	ND	ND/ND	ND	ND	ND	ND
Cadmium	0.27	0.24/0.25	ND	ND	0.51 J	0.60 J
Chromium	2.2	2.8/2.7	2.09	1.90	2.3 B,J	2.2 B,J
Copper	51	49/48	40.7	34.8	36	37
Lead	2.7	2.9/2.9	2.08	3.57	2.8	2.3
Mercury	0.13	0.10	ND	ND	0.047 J	0.041 J
Molybdenum	NT	NT	10.8	6.81	6.4 B	4.5
Nickel	2.8	4.2/4.3	3.91	4.05	2.5	3.2
Selenium	1.4	1.4/ND	ND	ND	1.3 J	ND
Silver	3.1	2.3/2.4	2.22	1.26	1.3	1.4
Thallium	ND	ND/ND	ND	ND	ND	ND
Zinc	100	97/96	83.8	84.8	120	110 B
<b>DISSOLVED METALS (µg/L)</b>						
Antimony	ND	ND	ND/ND	ND	0.39 J	0.33 J
Arsenic	1.2	1.9	1.93/1.95	1.69	ND	2.2 J
Beryllium	ND	ND	ND/ND	ND	ND	ND
Cadmium	ND	ND	ND/ND	ND	ND	ND
Chromium	0.79	0.55	1.32/1.50	1.33	1.1 J	3.5
Copper	1.4	26	25.4/25.2	26.9	14	15
Lead	0.064	0.42	ND/ND	2.34	0.78 J	0.64 J
Mercury	0.035	0.027	ND	ND	ND	ND
Molybdenum	NT	NT	9.95/10.2	6.19	6.4	4.2
Nickel	3.7	2.9	3.24/3.33	3.54	2.7	2.8
Selenium	9.6	1.1	ND/ND	ND	ND	2.5 J
Silver	ND	ND	1.01/1.07	ND	0.51 J	0.59 J
Thallium	ND	ND	ND/ND	ND	ND	ND
Zinc	3.3	35	48.7/48.0	49.5	20	27
<b>PESTICIDES (µg/L)</b>						
alpha-BHC	ND	0.023 J	ND	ND	ND	0.0082 J,COL
beta-BHC	ND	ND	ND	ND	ND	0.036 J,COL
Dieldrin	0.010 J,COL	0.021 J	ND	ND	ND	ND
Endosulfan II	ND	0.042 J	ND	ND	ND	ND
Endrin	ND	ND	ND	0.011 J, COL	ND	ND
Endrin ketone	0.012 J,COL	ND	ND	ND	ND	ND
Heptachlor	ND	0.54	0.015 J, COL	0.58	ND	ND
4,4'-DDD	ND	ND	ND	0.047 J	ND	ND
4,4'-DDE	0.0080 J,COL	ND	ND	0.016 J, COL	ND	ND
Malathion	ND	ND	ND	ND	ND	ND

*a* EPA method 1664 HEM *b* Duplicate effluent collected (field duplicate) or analyzed (lab duplicate) shown as value/duplicate value

\* Non-priority pollutants J Estimated value

CHI More than 40% RPD between primary and confirmation results. The higher of the two results is reported.

COL More than 40% RPD between primary and confirmation results. The lower of the two results is reported.

B Compound also detected in method blank ND Not detected NT Not tested



**Table 24. Historical Discharge Monitoring Data (1986 - Present) for Influent and Effluent Total Metals and Cyanide.** Concentrations are in µg/L. Values represent a range of minimum (Min) and maximum (Max) results for 1986-2001 as available. Results for 2003-2008 are from pretreatment monitoring (Avg of six results from both the wet and dry sampling events).

Year	Average Flow (mgd)	Arsenic		Beryllium		Cadmium		Copper		Lead		Mercury		Nickel		Silver		Zinc		Chromium		Cyanide	
		Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.	Inf.	Eff.
1986-2002 Min	23	<1	<1	<0.03	<0.03	0.4	0.2	36	10	<1	<1	<0.1	<0.1	<1	<1	2.1	1	54	38	<1	<1	<0.4	1
1986-2002 Max	40	26	16	0.6	0.2	20	30	280	150	149	50	3.0	1.5	77	60	30.4	98	260	407	112	120	85	50
2003 Avg	28	3	3	0.09	0.09	0.8	0.6	88	57	11	5	0.3	0.1	4	5	5.6	3.3	133	79	5	3	<10	<10
2003 Min	26	1	1	0.07	0.07	0.5	<0.5	79	49	5	2	0.2	0.1	2	<1	4.3	2.7	100	69	2	2	<10	<10
2003 Max	31	5	5	0.11	0.11	1.0	0.7	110	65	19	7	0.4	0.2	6	13	6.7	3.9	151	100	9	7	<10	<10
2004 Avg	29	3	2	0.2	0.2	0.4	<0.3	83	58	10	6	0.4	0.2	7	5	5.9	3.2	169	120	5	4	<10	<10
2004 Min	26	<2	<2	0.1	0.1	<0.3	<0.3	71	46	6	4	0.1	0.1	<6.2	<6.2	<1.5	<1.5	140	76	<6.2	<6.2	<10	<10
2004 Max	34	4	2	0.2	0.3	<6.2	<6.2	99	68	12	12	0.9	0.7	8	<6.2	7.2	3.9	192	150	<6.2	<6.2	<10	10
2005 Avg	28	3	3	0.1	0.1	0.4	0.3	90	53	7	4	0.3	0.1	9	5	3.3	1.7	155	92	6	4	<0.9	<0.9
2005 Min	24	2	<2	<0.1	<0.1	<0.3	<0.3	78	47	4	2	0.1	0.1	6	4	2.8	1.3	140	80	4	1	<0.9	<0.9
2005 Max	30	4	4	0.1	0.1	0.4	0.3	116	57	10	6	0.5	0.1	17	8	4.3	2.2	180	110	7	7	<0.9	<0.9
2006 Avg	28	3	3	0.5	0.5	0.4	0.3	84	57	5	3	0.1	0.1	7	4	4	3	190	99	7	3	1.0	1.7
2006 Min	26	3	2	<0.5	<0.5	0.3	0.2	75	48	2	2	0.1	0.1	4	3	2	2	180	94	4	2	<1.0	<1.0
2006 Max	32	3	3	<0.5	<0.5	0.5	0.4	93	77	8	4	0.2	0.1	11	6	6	3	200	110	15	7	<1.0	5
2007 Avg	28	2	2	<1.0	<1.0	<1.0	<1.0	63	39	4	2	0.3	<0.2	5	4	3	2	156	90	4	2	14	22
2007 Min	25	1	2	<1.0	<1.0	<1.0	<1.0	30	34	2	2	<0.2	<0.2	4	4	1	1	55	79	2	2	6	9
2007 Max	32	3	3	<1.0	<1.0	<1.0	<1.0	94	43	10	4	0.9	<0.2	9	4	3	2	299	105	7	3	25	59
2008 Avg	29	2	2	<1.0	<1.0	1.7	1.2	66	37	6	2	0.1	0.1	5	3	2	1	187	104	5	3	6	7
2008 Min	27	2	2	<1.0	<1.0	0.3	0.2	55	35	4	2	0.1	0.04	4	2	2	1	160	79	4	2	2	3
2008Max	30	3	3	<1.0	<1.0	6.8	4.9	92	41	13	3	0.2	0.1	6	3	3	2	290	120	8	3	10	10

Inf. Influent  
 Eff. Effluent  
 mgd million gallons per day

decrease is unknown; however, an increase in pH (to approximately 8.0) at the Water Treatment Facilities (Ship Creek and Eklutna) during the spring of 1991 caused a decrease in copper concentrations taken from "first draw" residential water sources in Anchorage. This increase in alkalinity was implemented to reduce corrosion in the drinking water distribution system. It would follow that these decreased values in drinking water would also affect the influent concentrations that have been consistently lower since that time.

Total arsenic concentrations in the final effluent had remained fairly steady over the last five years, and 2008 values remained well within the historic range. The maximum total arsenic concentration in final effluent seen during 2008 was 2.8 µg/L, compared to an MAEC of 4,882 µg/L (Table 21). Arsenic values are not a serious concern for this permit in terms of effluent concentrations, since the concentration in the final effluent is so much lower than the MAEC.

During 2008, cyanide concentrations in the effluent ranged from 0.19 to 10 µg/L, well below the MAEC of 181 µg/L. Cyanide had been a constituent of concern in past years because it approached or even exceeded the prior MAEC of 50 µg/L in some years. In 1986 it was observed that the effluent cyanide concentrations often exceeded the influent concentrations by an order of magnitude. This trend continued during subsequent years of sampling and was the subject of a special investigation conducted by the AWWU. The conclusion of this investigation was that the measured increase in cyanide between the influent and effluent was the result of the treatment plant's incinerator. Cyanide formed in the incinerator during sludge incineration is returned to the plant during the stack scrubbing process (CH2M Hill, 1987; CH2M Hill in association with Loren Leman, P.E., 1988). Subsequently, cyanide decreased and this was believed to be due to the change in the scrubbing water source from recirculated primary effluent to well water.

The most restrictive criteria of growth and propagation of fish, shellfish, other aquatic life, and wildlife was used for the hydrocarbon limits presented in Table 21. The MAECs for TAqH and total aromatic hydrocarbons as BETX were met again this year, with maximum levels in the effluent well below the state-specified limits. The parameter of TAqH was analyzed in effluent only during the receiving water quality sampling, and the TAqH concentration was 14.18 µg/L as compared to the MAEC of 2,715 µg/L. The maximum BETX value measured by the EPA 624 method of 19.0 µg/L was seen during the toxic pollutant and pesticide August 2008 sampling, and this value fell well below the MAEC of 1,810 µg/L.

The MAEC for total ammonia was met again this year, with effluent values exhibiting a maximum of 22.5 mg/L as compared to the MAEC of 1,774 mg/L. This MAEC is based on maximum criteria in saltwater of 9.8 mg/L based on a salinity of 20 psu, temperature of 15 °C, and a pH of 8.0 units (EPA, 1989).

In addition to the MAECs based on the State and Federal water quality criteria, a number of other effluent limitations are specified in the NPDES permit. These daily, weekly, and monthly limitations include pH, TRC, BOD<sub>5</sub>, TSS, and fecal coliform (Table 21). All of these parameters met all permit limitations for 2008.

For fecal coliform, the permit limitation of a monthly geometric mean (of at least five samples) that shall not exceed 850 FC MPN/100 mL was not exceeded this year, with the maximum monthly geometric mean of 63 FC MPN/100mL. Fecal coliform also met the monthly criteria

"that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL during any month" for all of 2008.

The permit limitations for monthly and weekly averages and daily maximum were met for BOD<sub>5</sub> and TSS. Amendments to the Clean Water Act (40 CFR; Final Rule, 8/9/94), require at least 30 % average monthly removal for both of these parameters. BOD<sub>5</sub> and TSS met this requirement on both an average monthly and annual basis with the lowest monthly removal of 31% for BOD and 73% for TSS. Removal of BOD<sub>5</sub> averaged 39 % for the 2008 calendar year which is slightly higher than that seen compared to the past five years where average annual removals ranged from 33 to 36 %. The monthly removal for TSS ranged from 73 to 80 % with an annual average of 77 %, about the same as reported for the last ten years and well above the average monthly criteria of 30 %.

Concentrations of other toxic pollutants and pesticides detected in the influent and final effluent were generally lower than or within the range of those detected in other POTWs from across the nation, even though the Asplund WPCF provides only primary treatment as compared to secondary treatment provided at the other plants (Table 22). Toxic pollutants and pesticides also generally fell within the historical range of values seen in past years; levels of toxic pollutants and pesticides detected in the Anchorage effluent this year and over the previous five years are shown in Table 23. These data indicated some variability over time, but a generally similar pattern overall. Levels were low and often below reporting limits. As in the past, the types and concentrations of measured organic compounds varied between the two sampling periods. Also, in some instances, large differences in pollutant concentrations occurred between the influent and effluent. Inconsistencies can be explained by looking at sampling methodology and plant operation in the case of point-source contaminants. If spikes of contaminants are occurring in the influent, these might be hit or missed during sampling. On the other hand, an effluent sample could contain the contaminant because of mixing in the clarifiers. Differences in concentrations in influent and effluent samples could also be due to lower suspended solids in the effluent samples. This can be seen in Table 9 and Table 10, where greater variability usually occurs in the influent concentrations as compared to the effluent.

Historic discharge monitoring data (1986 - 2008) for other parameters of concern measured in the influent and effluent are presented in Table 25. Most parameters have remained fairly steady over time. Dissolved oxygen levels increased from 1986 with a peak in 1992, and then generally decreased over the next ten years. Levels of DO over the past six years including 2008 have been fairly consistent and generally in the range of 2 to 6 mg/L. Other constituents of potential concern such as TSS have remained fairly steady in both the influent and effluent over the past six years and within the range of that seen historically. The BOD<sub>5</sub> effluent average during 2008 (131 mg/L) is slightly lower than that seen during the prior five years and well within the range seen historically. Average BOD<sub>5</sub> levels in the influent in 2008 were also slightly lower than that seen over the prior five years with the exception of 2005.

The yearly average effluent fecal coliform bacteria concentration, reported at 20 MPN/100 mL for 2008, was similar to that seen in 2007 and considerably lower than the prior four years. Elevated levels seen in 2004 were the highest yearly average seen on the program to date and were most likely the result of a program to optimize chlorine usage as described below. Lower fecal coliform values for 2006 through 2008 showing a downward trend are more in line with prior data, indicating that the disinfection efficacy at the WPCF has been improving.

**Table 25. Historical Mean Monthly Discharge Monitoring Data (1986-Present) for Influent and Effluent Non-Metals.**

Year	Temperature (°C)		pH <sup>a</sup>		TRC (mg/L)		DO (mg/L)		BOD <sub>5</sub> (mg/L)		TSS (mg/L)		Fecal Coliform (MPN/100 mL)		Ammonia (mg/L)	
	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
1986-2002 Min	9	9	6.4	6.4	NT	0.3	NT	2.1	98	69	117	37	NT	5	NT	13.8
1986-2002 Max	17	18	8.2	8.5	NT	1.0	NT	8.6	296	174	307	86	NT	726	NT	29.3
2003 Avg	13.6	14.0	NA	NA	NT	0.26	NT	4.9	252	161	235	48	NT	210	NT	21.8
2003 Min	11.4	11.2	6.9	6.6	NT	0.07	NT	3.8	228	155	215	44	NT	38	NT	20.3
2003 Max	16.1	17.1	7.8	8.1	NT	0.57	NT	6.3	269	170	252	52	NT	1141	NT	23.5
2004 Avg	12.9	13.6	NA	NA	NT	0.26	NT	3.9	226	148	229	49	NT	325	NT	20.9
2004 Min	10.6	11.2	6.7	6.6	NT	0.1	NT	2.1	205	133	204	45	NT	57	NT	17.2
2004 Max	16.2	17.2	8.0	8.1	NT	0.49	NT	5.2	259	168	280	51	NT	1213	NT	24.2
2005 Avg	12.7	13.2	NA	NA	NT	0.30	NT	4.6	205	148	235	54	NT	175	NT	20.0
2005 Min	10.7	11.1	7.4	7.2	NT	0.17	NT	3.1	194	131	216	45	NT	19	NT	18.5
2005 Max	15.6	16.1	7.9	7.5	NT	0.55	NT	6.2	284	174	273	58	NT	484	NT	22.0
2006 Avg	12.0	12.3	NA	NA	NT	0.34	NT	4.0	220	146	229	54	NT	44	NT	19.4
2006 Min	9.8	10.0	6.7	6.5	NT	0.18	NT	2.6	199	132	196	50	NT	4	NT	17.0
2006 Max	14.8	15.1	7.8	8.1	NT	0.56	NT	5.3	237	165	268	59	NT	229	NT	21.5
2007 Avg	11.8	11.9	NA	NA	NT	0.38	NT	3.7	229	148	231	57	NT	18	NT	19.3
2007 Min	9.4	9.9	6.6	6.5	NT	0.25	NT	1.5	180	124	195	48	NT	3	NT	17.2
2007 Max	14.6	15.4	8.0	7.9	NT	0.57	NT	6.1	279	174	284	66	NT	76	NT	22.9
2008 Avg	12.0	11.9	NA	NA	NT	0.35	NT	2.9	211	131	223	51	NT	20	NT	19.9
2008 Min	10.0	9.3	6.8	6.6	NT	0.20	NT	2.2	189	119	194	46	NT	6	NT	16.1
2008 Max	14.2	15.1	8.5	7.7	NT	0.49	NT	3.8	244	149	265	56	NT	63	NT	22.5

<sup>a</sup> Values represent monthly pH minimum and maximum

NA Not applicable

NT Not tested

As described in earlier reports, a project to improve the efficiency of the Asplund WPCF effluent disinfection system was implemented during 2001-2002. The chlorine injection process was improved by installation of rapid mixing equipment (the “Water Champ”, installed in November 2001) to mix chlorine gas directly with the effluent. Oxidation Reduction Potential (ORP) technology using a *Stranrol 890 Controller* was installed in December 2001 to control the chlorine dosage rate by adjusting it in response to both flow and oxidation reduction potential of the wastewater. Prior to this improvement, it was never possible to determine an exact correlation between TRC and coliform kill. Dosage control by the ORP has resulted in adequate coliform kills with far lower residuals and has substantially reduced the annual chlorine usage, but optimizing the disinfection process has been an on-going process.

The average TRC had dropped from 0.8 mg/L in 2001 to 0.4 mg/L in 2002, and TRC levels fell even lower in 2003 and 2004, with average TRC values of 0.26 mg/L for both of these years. The average TRC increased slightly in 2005 and 2006 with values of 0.30 and 0.34 mg/L, respectively. The average TRC in 2008 was slightly higher with an average concentration of 0.35 mg/L with a range similar to that seen in 2005 through 2007. The average fecal coliform monthly average rose from 39 FC MPN/100 mL in 2001 to a high of 325 FC MPN/100 mL in 2004, and in 2008 has dropped back even further to 20 FC MPN/100 mL. As noted above, there were no exceedances in fecal coliform permit limits in 2008.

Quarterly WET testing was conducted on 24-hr flow composite effluent samples during all four quarters of calendar year 2008. Echinoderm fertilization tests were performed during the first, second, and third quarters of 2008. Use of this test during the first, second, and third quarters was based on the screening test results from the third quarter of 2007, which had determined the sea urchin to be the most sensitive species tested. Annual three-species re-screening for the most sensitive species in 2008 was performed during the fourth quarter, and the sea urchin was again found to be the most sensitive species. Although a toxic response was seen from the effluent during all four quarters of WET testing, all results were found to be acceptable and within the permit specified limit of  $TUc < 143$  and required no additional testing.

***In summary, effluent chemistry monitoring indicated that with no exceptions, effluent concentrations of toxic pollutants and pesticides, metals and cyanide, and conventional parameters were much lower than their applicable permit limits or their MAECs. Fecal coliform also met all permit specified criterion in 2008. All toxic pollutants and pesticides concentrations including metals and cyanide were lower than or within the range of those detected at secondary treatment plants from across the nation.***

### **5.1.2 Sludge Monitoring**

The current permit requires sludge monitoring twice per year, once each during the dry and wet conditions in summer as part of the toxic pollutant/pretreatment monitoring. There are no Part 503 monitoring requirements included in the permit, but sludge monitoring is required because the Part 503 regulations are self-implementing as described in Section 2.1.5. Part 503 monitoring of sludge at Asplund WPCF has been included in this report (Table 13) and will also be reported separately to EPA as required by the regulations by 19 February 2009.

While limits for levels of toxic pollutants and pesticides in sludge are not part of the current permit, comparisons can be made for these data based on other treatment facilities' monitoring results and to the site specific allowable limits for metals that were determined for the facility. In

all cases, sludge metals were found to be substantially lower than the site specific allowable limits (Table 13). Again, data indicate that concentrations of toxic pollutants and pesticides in Anchorage's sludge are generally lower than "typical" concentrations seen at other treatment facilities (Table 26). For the last three years, arsenic concentrations in sludge were less than those typically seen, however in 2008 arsenic was slightly higher with an average of 4.7 µg/g compared to a typical concentration of 4.6 µg/g. Arsenic ranged from <3.24 to 5.40 µg/g during 2008. The average mercury concentration measured during the Part 503 sampling was 0.81 µg/g, below the typical concentration of 1.49 µg/g. Mercury concentrations measured during the two toxic pollutant sampling were also less than the typical concentrations. The other Part 503 metals tested (beryllium, cadmium, chromium, lead, and nickel) also fell below typical concentrations.

Other metals that were monitored but not a requirement of the Part 503 regulations were copper, selenium, and zinc. Copper concentrations were below typical concentrations during both the June and August sampling. Zinc concentrations exceeded the typical concentration in August with a concentration of 690 µg/g compared to the typical value of 678 µg/g and a 95<sup>th</sup> percentile concentration of 4,580 µg/g. The selenium values reported for the June and August 2008 samplings event were 2.5 and 3.8 µg/g, respectively, compared to the typical concentration of 1.11 µg/g and a 95<sup>th</sup> percentile concentration of 4.85 µg/g.

Table 27 provides an overview of historical sludge data for total recoverable metals. In general, year 2008 data indicated similar concentrations of arsenic, cadmium, chromium, lead, mercury, and nickel compared to historical data over the last few years. Beryllium was detected in the 2008 June and August toxic pollutant sampling at estimated concentrations of 0.08 and 0.14 µg/g, compared to the typical concentration of 0.313 µg/g (Table 26).

## **5.2 WATER QUALITY MONITORING**

### **5.2.1 Plume Dispersion Sampling**

To test the hypothesis that the water quality at the ZID boundary was not degraded with respect to the water quality at the nearfield and control stations, the non-parametric Kruskal-Wallis Test (Zar, 1984) was employed which determined whether significant differences occurred within the sample group. If significant differences were observed, Dunn's test, a test that performs pairwise tests of significance ( $\alpha = 0.05$ ), was employed (Dunn, 1964). The results of these tests for the June survey period as a function of water quality parameters are presented in Table 28. Non-detect values were replaced with the detection limit value for statistical testing.

Data from the receiving water survey showed statistically significant differences between outfall and control stations for both temperature and salinity for all depths. These differences were the result of the control stations being warmer and slightly less saline; however, even though significant differences were found, these differences were very small. In the past the control stations have often been found to be less saline as a result of increased river influence on the north side of Knik Arm. No significant differences were seen for turbidity for any depths or

**Table 26. Comparison Between Sludge Analysis Results for Anchorage and Typical and Worse Case Concentrations Used by EPA in Developing Median or Mean Environmental Profiles<sup>a</sup>. All concentrations are in µg/g dry weight.**

Pollutant	2008 Anchorage Values			Typical Concentration	95 <sup>th</sup> Percentile "Worse Case"
	June <sup>b</sup>	August <sup>b</sup>	2008 AVG <sup>c</sup>		
Aldrin/Dieldrin	ND (0.029)	ND (0.007)/ ND (0.007)	---	0.07	0.81
Arsenic	4.7	5.4	4.7	4.6	20.77
Benzene	ND (1.7)	ND(0.069)	---	0.326	6.58
Benzo(a)anthracene	ND (11)	ND (25)	---	0.68	4.8
Benzo(a)pyrene	ND (11)	ND (25)	---	0.14	1.94
Beryllium	0.08 J	0.14 J	N/A	0.313	1.168
Bis(2-ethylhexyl)phthalate	20	20 J,B	---	94.28	459.25
Cadmium	1.4	1.8	1.4	8.15	88.13
Carbon Tetrachloride	ND (1.7)	ND(0.069)	---	0.048	8.006
Chlordane (α,γ)	ND (0.029)/ ND (0.029)	ND (0.007)/ ND (0.007)	---	3.2	12
Chloroform	ND (1.7)	ND (0.14)	---	0.049	1.177
Chromium	24 B	13	13.7	230.1	1499.7
Copper	210 B	240	---	409.6	1427
Cyanide	0.71 J	0.42 J	---	476.2	2686.6
DDT/DDE/DDD	ND (0.029)/ ND (0.029)/ ND (0.029)	ND (0.007)/ ND (0.007)/ ND (0.007)	---	0.28	0.93
3,3-Dichlorobenzidine	ND (22)	ND (50)	---	1.64	2.29
Methylene chloride	ND (1.7)	0.021 J,B	---	1.6	19
Endrin	ND (0.029)	ND (0.007)	---	0.14	0.17
Hexachlorobenzene	ND (11)	ND (25)	---	0.38	2.18
Hexachlorobutadiene	ND (11)	ND (25)	---	0.3	8
Lead	19	21	21.4	248.2	1070.8
gamma-BHC (Lindane)	ND (0.029)	ND (0.007)	---	0.11	0.22
Malathion	ND (0.51)	ND (2.5)	---	0.045	0.63
Mercury	0.9	0.62	0.8	1.49	5.84
Nickel	11	12 L	11.5	44.7	662.7
PCBs	ND (0.11)- ND (0.16)	ND (0.14)- ND (0.19)	---	0.99	2.9
Pentachlorophenol	ND (53)	ND(120)	---	0.0865	30.434
Phenanthrene	0.79 J	ND(25)	---	3.71	20.69
Phenol	ND (11)	ND(25)	---	4.884	82.06
Selenium	2.5	3.8 B	---	1.11	4.848
Tetrachloroethene	0.19 J	0.041 J	---	0.181	13.707
Trichloroethene	ND (1.7)	ND (0.069)	---	0.46	17.85
2,4,6-Trichlorophenol	ND (11)	ND(25)	---	2.3	4.6
Vinyl Chloride	ND (1.7)	ND (0.069)	---	0.43	311.942
Zinc	550 B	690	---	677.6	4580

<sup>a</sup> Source: EPA 1985c. *Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Methods and Results*. Office of Water Regulations and Standards, Appendix F.

<sup>b</sup> Data from NPDES 2008 toxic pollutant and pesticide monitoring

<sup>c</sup> Average from 2008 Part 503 sludge monitoring results

--- Not monitored in-plant for Part 503 ND ( ) Not detected (detection limit)

L Physical and chemical interferences present. N/A Not applicable

B Method blank contamination. J Estimated value (below MDL or MRL)

**Table 27. Historical Discharge Monitoring Data (1986 - Present) for Metals in Sludge.**

Year	Arsenic	Beryllium	Cadmium	Chromium (Total)	Lead	Mercury	Nickel
<b>1986-2002 Min</b>	1.7	<0.02	0.7	3.38	24	<0.1	<8
<b>1986-2002 Max</b>	151	0.22	10.0	55	468	7.3	42
2003 Avg	2.2	0.15	1.9	14	29	1.3	20
2003 Min	1.7	0.07	0.7	8	19	0.9	7
2003 Max	2.9	0.23	2.7	19	47	2.1	53
2004 Avg	3.0	0.14	1.9	16	25	1.3	14
2004 Min	2.5	0.11	1.3	11	20	0.7	9
2004 Max	3.8	0.18	3.0	21	30	2.1	17
2005 Avg	2.4	0.21	2.4	14	25	1.5	16
2005 Min	1.8	0.13	1.7	12	10	<0.02	11
2005 Max	2.7	0.37	3.0	19	33	3.1	20
2006 Avg	3.8	0.06	2.1	17	26	0.86	15
2006 Min	1.9	ND	1.2	13	18.2	0.39	11.9
2006 Max	5.94	0.15	3.0	25	39.3	1.70	19
2007 Avg	5.00	N/A	1.6	14.5	18.9	0.82	11.0
2007 Min	ND(<3.2)	ND(<0.31)	1.0	12.8	9.8	0.58	9.43
2007 Max	7.85	ND(<3.38)	2.4	15.8	25.1	1.04	13.4
2008 Avg	4.73	N/A	1.35	13.7	21.4	0.812	11.5
2008 Min	ND(<3.2)	0.08J	1.02	9.77	15.4	0.357	8.34
2008 Max	5.40	ND(<0.42)	1.80	31.2	31.2	1.93	13.6

N/A – Not applicable

locations. pH units were found to be significantly between the nearfield station and the control for all depths. No significant differences in pH were seen between the within-ZID and ZID boundary stations when compared to either nearfield or control locations. No significant differences were seen for dissolved oxygen, color, fecal coliform or TRC.

Although statistic differences were seen, all pH values fell within the AWQS of 6.5 - 8.5 and values did not vary more than 0.2 pH units that would be attributed to the outfall, as required by the AWQS. For color, concentrations were found to be all below the detection limit of 5 color units. In 2007, color was found to be elevated at all locations compared to most prior years, and was believed to be due to the naturally high suspended sediment levels in the samples from Knik Arm that were not completely removed from the samples prior to analysis. During 2008, color samples were allowed to settle and decanted prior to either filtration or centrifuging by the laboratory which resulted in much better sample analysis results. It is anticipated that this procedure will be continued in future years.



**Table 28. 2008 Station Group Differences at the 5 Percent Significance Level ( $p \leq 0.05$ ) as determined by the Nonparametric Kruskal-Wallis (ANOVA) and Dunn's (ad hoc multiple comparison) Statistical Analysis Tests.**

Water Quality Parameter	Water Column Depth		
	Surface	Middle	Bottom
<u>Conventional Analyses*</u>			
Temperature	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4
Salinity	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4	<u>1 2 3</u> vs. 4
Dissolved Oxygen	NS	NS	NS
pH	<u>1 2 3</u> vs. <u>1 2 4</u>	<u>1 2 3</u> vs. <u>1 2 4</u>	<u>1 2 3</u> vs. <u>1 2 4</u>
Turbidity	NS	NS	NS
Color Units	NS	----	----
Fecal Coliform	NS	----	----
Total Residual Chlorine	NS	----	----
<u>Metal and Hydrocarbon Analyses**</u>			
Arsenic	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Cadmium	NS <sup>D</sup> , NS <sup>TR</sup>	----	----
Chromium	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Copper	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Mercury	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Nickel	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Lead	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Silver	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Zinc	NS <sup>D</sup> , <b>SIG</b> <sup>TR</sup>	----	----
Cyanide	NS <sup>TR</sup>	----	----
Total Suspended Solids	<b>SIG</b> <sup>TR</sup>	----	----
Total Aromatic Hydrocarbons (BETX)	NS <sup>TR</sup>	----	----
Total Aqueous Hydrocarbons (TAqH)	NS <sup>TR</sup>	----	----

\* Tests were performed on four Station Groups (Group 1: Within-ZID Sites; Group 2: ZID Boundary Sites; Group 3: Nearfield Sites; and Group 4: Control Sites). Bolded Groups signify **SIG** result. Underlined Groups are not significantly different from each other (Dunn's Test result,  $p > 0.05$ ).

\*\* Tests performed on stations located between the outfall (Drogue F1 sites) and the control (Drogue C1 sites).

---- Not Applicable (surface samples only)

NS Not Significant K-W Test Result ( $p > 0.05$ )

**SIG** Significant K-W Test Result ( $p \leq 0.05$ )

<sup>D</sup> Dissolved

<sup>TR</sup> Total Recoverable

In addition to the standard water quality sampling, concentrations of total aromatic hydrocarbons (TAH) as BETX and TAqH were measured at the surface at six stations (three at the control site and three at the flood tide outfall site, along the first drogue track). No statistically significant differences in BTEX or TAqH concentrations were detected between the control and outfall stations. There were no BTEX concentrations above MDLs seen at the Control Stations. One ZID Station, F1-1 within the mixing zone, had a BTEX value slightly above the MDL however, it was well below, the State of Alaska water quality standard of 10 µg/L. One other ZID Station and the associated field duplicate had estimated BTEX values. TAqH concentrations were seen at all six stations but with a maximum of 2.5 µg/L, significantly less than the AWQS of 15 µg/L. In addition, comparison of TPAH concentrations did not indicate that levels were elevated at the outfall, although this has sometimes been seen in the past. All TPAH levels were relatively low.

Total suspended solids, cyanide, and total recoverable and dissolved metals samples collected at the outfall and control sites were also subject to statistical testing. The statistically significant differences that were noted were for TSS and for all of the total recoverable metals with the exception of cadmium. Total metals concentrations were found to be elevated at all three control locations and which were directly attributable to the high TSS concentrations at the control site. Station C1-3 was found to have the highest TSS level and also the highest total metal concentrations for each of the metals that were tested. Since the total concentrations were higher at the control site and since the TSS levels were also higher the statistical differences were not caused by the Pt. Woronzof discharge.

No significant differences were seen for any of the dissolved metals, or cyanide. Although not statistically significant, dissolved levels of cadmium, mercury, lead, and silver were found to be slightly higher at Station F1-1 that is located within the mixing zone. This may be an outfall related effect, although all concentrations were still well below AWQS site specific criteria.

A comparison of the water quality data listed in Table 15 with the marine receiving water quality for the State of Alaska (Table 21 and Table 29) indicates that none of the parameters listed in Table 15 exceeded the State's standards. All of the TRC concentrations were below the PQL of 0.10 mg/L. It should be noted that the lowest achievable method detection limit in 2008 for the analysis of TRC in seawater (0.10 mg/L) is higher than both the State-specified limits of 0.0075 mg/L for chronic 4-day average and 0.014 mg/L limit for acute 1-hr average for marine water use. As previously noted, although the amperometric method that was used is the preferred method due to less interference, all TRC methods are subject to positive interferences in estuarine or marine waters. In past years, some of the highest TRC levels were seen at the control stations.

The State's receiving water quality standard for the "growth and propagation of fish, shellfish, aquatic life, and wildlife including seabirds, waterfowl, and furbearers" is 15 µg/L for TAqH and 10 µg/L for total aromatic hydrocarbons. As seen in Table 17, these standards were not exceeded during the receiving water sampling. For all control stations, BETX was at or below the method detection limit and well below the state standards. One outfall station (F1-1) had a measurable BTEX value of 2.4 µg/L well below the state standards while at the other two outfall stations BTEX was at or below the level of detection. In addition, for "contact recreation", the AWQS for hydrocarbons is as follows: "Shall not cause a film, sheen, or discoloration on the

**Table 29. State of Alaska Water Quality Standards for Receiving Water.**

Parameter	Most Restrictive Marine Water Quality Standards								
Fecal Coliform	Based on a 5-tube decimal dilution test the fecal coliform median MPN shall not exceed 14 FC/100 mL (harvesting for consumption of raw shellfish); a geometric mean of 20 FC/100 mL (for aquaculture of products not normally cooked and seafood processing); and not more than ten percent (10%) of the samples shall exceed 40 FC/100 mL (aquaculture of products not normally cooked and seafood processing).								
Dissolved Oxygen	Dissolved oxygen concentrations in estuaries and tidal tributaries shall not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.								
pH	pH shall not be less than 6.5 or greater than 8.5, and shall not vary more than 0.2 pH unit from natural condition.								
Turbidity	Turbidity may not exceed the natural condition.								
Temperature	Temperature shall not cause the weekly average temperature to increase more than 1° C. The maximum rate of change shall not exceed 0.5° C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.								
Salinity	Maximum allowable variation above natural salinity: <table> <tr> <th>Natural Salinity (‰)</th><th>Man-induced Salinity (‰)</th></tr> <tr> <td>0 to 3.5</td><td>1</td></tr> <tr> <td>3.5 to 13.5</td><td>2</td></tr> <tr> <td>13.5 to 35.0</td><td>4</td></tr> </table>	Natural Salinity (‰)	Man-induced Salinity (‰)	0 to 3.5	1	3.5 to 13.5	2	13.5 to 35.0	4
Natural Salinity (‰)	Man-induced Salinity (‰)								
0 to 3.5	1								
3.5 to 13.5	2								
13.5 to 35.0	4								
Sediment	No measurable increase in concentrations above natural conditions.								
Color	Color shall not exceed 15 color units or the natural conditions, whichever is greater.								
Petroleum Hydrocarbons, Oils and Grease	Total aqueous hydrocarbons (TAqH) in the water column shall not exceed 15 µg/L. Total aromatic hydrocarbons (TAH) in the water column shall not exceed 10 µg/L. Shall not cause a film, sheen, or discoloration on the surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils.								
Total Residual Chlorine	Shall not exceed 13 µg/L (one hour average) acute, and 7.5 µg/L (four day average) chronic; for marine aquatic life.								
Toxic and Other Deleterious Substances	See Table 21.								

Temperature shall not cause the weekly average temperature to increase more than 1° C. The maximum rate of change shall not exceed 0.5° C per hour. Normal daily temperature cycles shall not be altered in amplitude or frequency.

surface or floor of the water body or adjoining shorelines. Surface waters shall be virtually free from floating oils." No film, sheen, or discoloration was observed during the receiving water sampling program in 2008.

All the dissolved metals tested in receiving water (Table 16) as part of this program met the AWQS as shown in Table 21, even at Station F1-1 within the ZID. These included: arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. Testing of antimony, beryllium, selenium, and thallium in receiving water is not required by the permit and was not performed in 2008. Previous years of monitoring showed exceedances of water quality criteria for total recoverable metals that were due to the specified test methods in conjunction with high amounts of suspended particulates in Cook Inlet. Since the adoption of the more-appropriate SSWQC for dissolved metals in May 1999, the receiving waters of Cook Inlet near the Asplund WPCF discharge have been in compliance with the AWQS.

All cyanide samples collected during the receiving water sampling were below the State-specified criteria of 1 µg/L for marine aquatic life. The highest cyanide concentration that was seen in 2008 was at Station F1-3 with a reported value of 0.21 µg/L. The cyanide concentrations in the effluent samples, that were measured as part of the receiving water sampling, was reported at a concentration of 0.19 and 0.25 µg/L, well below the MAEC of 181 µg/L.

***In summation, statistical analyses of the 2008 receiving water quality data indicated that water quality outside the ZID was not degraded with respect to control stations for any parameters. Differences that were noted in some parameters such as salinity, temperature, and pH were unlikely to be influenced by the Asplund WPCF outfall. All AWQS were met in 2008 for the Asplund WPCF receiving water quality program. Although some dissolved metal parameters appeared to be slightly elevated at the closest outfall station as compared to control stations, no statistically significant increases at the outfall stations were seen and all parameters were well below AWQS. Statistically significant differences between the outfall and control site were seen for most of the total metals due to higher levels at the control site that were directly correlated with the higher levels of naturally occurring total suspended solids and were not an outfall related effect. No statistically significant differences were seen for cyanide, TAH, or TAqH hydrocarbon concentrations between the outfall and control locations and all cyanide and hydrocarbon concentrations were below AWQS.***

### **5.2.2 Fecal Coliform Bacteria**

In the past, the ADEC has indicated that one of their primary concerns is bacterial contamination of the shoreline by the Asplund discharge, indicated by fecal coliform bacteria concentrations. Because the Knik Arm's water uses have not been classified, regulations provide that the most restrictive standard must apply. State marine water quality standards for contact recreation require that the geometric mean fecal coliform concentration taken within a 30-day period not exceed 100 FC MPN/100 mL and that not more than one sample, or more than 10 % of the samples if there are more than 10, exceed 200 FC MPN/100 mL. Criteria for secondary recreation and for industrial water supply require that the mean fecal coliform concentration not exceed 200 FC MPN/100 mL and that not more than 10 % of the samples exceed 400 FC MPN/100 mL. State marine water quality criteria for the harvesting for consumption of raw mollusks and other raw aquatic life require that, based on a 5-tube decimal dilution test, the median shall not exceed 14 FC MPN/100 mL, and that not more than 10 % of the samples shall exceed 43 FC MPN/100 mL. For seafood processing water supply for products not normally

cooked, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 40 FC MPN/100 mL. For seafood processing water supply for products normally cooked, criteria are that the geometric mean may not exceed 200 FC MPN/100 mL, and not more than 10 % of the samples shall exceed 400 FC MPN/100 mL. For aquaculture water supply, criteria are that the geometric mean may not exceed 20 FC MPN/100 mL and not more than 10 % of the samples may exceed 40 FC MPN/100 mL.

Since the harvesting of shellfish and other raw aquatic life is not performed in these waters, and there is no aquaculture or seafood processing, it seems that the criteria for secondary recreation is most applicable; however, these criteria are not the most restrictive. Therefore, the most restrictive criteria used were that the median shall not exceed 14 FC MPN/100 mL (consumption of raw shellfish and other aquatic life), the geometric mean shall not exceed 20 FC MPN/100 mL (seafood processing and aquaculture for raw consumption), and not more than 10 % shall exceed 40 FC MPN/100 mL (seafood processing and aquaculture for raw consumption; Table 29).

Statistical tests indicated that fecal coliform concentrations were not significantly different between the within-ZID, ZID boundary, and the nearfield outfall station groups as compared to the control stations (refer to Table 28). Fecal coliform concentrations were very low again this year, and values ranged from <2 to 23 FC MPN/100 mL at the outfall stations (including the ZID stations) and a range of <2 to 17 FC MPN/100 mL at the control stations. The median at the control stations was 2 FC MPN/100 mL, and the median at the all outfall stations was <2 including stations both within and outside the ZID for both ebb and flood tides, well within the 14 FC MPN/100 mL criterion. The control site had a geometric mean of 2.7 FC MPN/100 mL, while that at the all the outfall stations (inside and outside the ZID) was 2.6 FC MPN/100 mL, both well below the criterion of 20 FC MPN/100 mL. No measurements (0 %) at the outfall stations either within or outside the ZID exceeded 40 FC MPN/100 mL, compared to the criteria of not more than 10 % of the measurements may exceed 40 FC MPN/100 mL. No samples collected at the control stations exceeded this criterion. The highest fecal coliform concentration (23 FC MPN/100 mL) was seen this year at a within-ZID outfall station (F1-1), at low slack tide.

Relatively low fecal coliform bacterial concentrations were seen in all three creeks sampled as compared to historical data, although all creek concentrations were still higher than either the receiving water or intertidal samples that were collected. The two replicate fecal coliform concentrations measured in Fish Creek were 4 and 13 FC MPN/100 mL. Replicate concentrations measured in Ship Creek were slightly higher at 9 and 23 FC MPN/100 mL, while those at Chester Creek were 7 and <2 FC MPN/100 mL.

The range of fecal coliform concentrations for all intertidal samples collected during 2008 was quite low at <2 to 2 FC MPN/100 mL, with a median of <2 FC MPN/100 mL and a geometric mean of 2 FC MPN/100 mL. These values met the most restrictive water quality criterion of a median of 14 FC MPN/100 mL and a geometric mean of 20 FC MPN/100 mL. The highest coliform concentrations were seen at Stations IT-3, 750 m east of the outfall and IT-5, 250 m southwest of the outfall. Due to the very low values encountered in 2008 throughout the study area, it is clear that the outfall was not affecting the intertidal zone during this sampling event. The criterion of not more than 10 % of the samples exceeding 40 FC 100/mL was met, as none of the intertidal measurements exceeded this value. Although not seen in this year's data, in the past, the slightly elevated fecal concentrations seen intertidally were attributed to heavy waterfowl use of the area. Fecal coliform concentrations in the effluent samples collected in conjunction with the receiving water, intertidal sampling, and stream sampling were also low at 4

and 6 FC MPN/100 mL for the two replicates. These values were slightly lower than the average monthly values reported, which ranged from 6 to 63 FC MPN/100 mL (Table 8).

*In summary, fecal coliform concentrations in 2008 were found be very low in both the receiving water and intertidal areas. No statistically significant differences were seen between station groupings for the ZID, ZID-boundary, or nearfield stations as compared to the control location. All three area creeks were also found to be low in fecal coliform concentrations in 2008. Fecal coliform samples collected during the receiving water sampling program met all AWQS criteria, including all outfall stations both within and outside the ZID. All fecal coliform samples collected from intertidal areas also met all water quality criteria.*

## 6.0 CONCLUSIONS

The following conclusions were based on results from this year of monitoring as compared to the current NPDES permit:

- The influent, effluent, and sludge monitoring showed, that with no exceptions, the Asplund WPCF met the NPDES permit requirements and complied with AWQS. MOA's self-monitoring of TRC, pH, fecal coliform, BOD<sub>5</sub>, and TSS showed compliance with all permit effluent limitations in 2008.
- MOA's self-monitoring of TRC and pH showed that the permit limit for daily maximum TRC levels in the effluent was never exceeded and pH fell within permit limits in 2008.
- The permit limit of a monthly maximum geometric mean of 850 fecal coliform by most probable number technique per 100 milliliters (FC MPN/100 mL) was not exceeded in 2008. The fecal coliform monthly criteria "that not more than 10 % of the effluent samples shall exceed 2600 FC MPN/100 mL was also met for every month in 2008.
- MOA's self-monitoring of TSS and BOD<sub>5</sub> showed compliance with both regulatory and permit effluent limitations. TSS and BOD<sub>5</sub> were well within the daily, weekly, and monthly criteria for the entire year. Average monthly removals for BOD<sub>5</sub> and TSS of greater than 30 % are required by the amendment to the Clean Water Act (40 CFR Part 125; Final Rule, 8/9/94). The removal rate for both TSS and BOD<sub>5</sub> were greater than the 30% minimum removal requirement for all months during 2008. Annual removals were 77 % for TSS and 39 % for BOD<sub>5</sub> which indicate excellent plant performance.
- Total aromatic hydrocarbon (TAH), total aqueous hydrocarbon (TAQH), and total ammonia concentrations in the effluent were all found to be below their maximum allowable effluent concentrations (MAECs) in 2008.
- Cyanide and metals concentrations in the effluent never exceeded their MAECs at any time during any of the 2008 sampling events.
- Concentrations of toxic pollutants and pesticides, including metals and cyanide, in influent and effluent were all within the established range or lower than values from a national study of secondary treatment plants (EPA 1982a).
- Toxic pollutant sludge concentrations were found to be very low compared to the limits established under 40 CFR Part 503 and all were either not-detected or within the established range or lower than values from a national study of secondary treatment plants, with most metals falling at or below the typical concentrations and all metals well below 95<sup>th</sup> percentile worst case values (EPA 1985c).
- Whole effluent toxicity testing conducted quarterly met all permit limitations for toxicity for all species and all sampling events in 2008.
- Receiving water monitoring showed little variation among stations for most hydrographic parameters indicating that the receiving water environment is uniform and well mixed near the outfall.

- To test the hypothesis that the water quality at the zone of initial dilution (ZID) boundary was not degraded with respect to the water quality at the nearfield and control sites, statistical comparisons were employed. Conventional parameters such as salinity, temperature, TSS, and pH did show statistically significant differences between sites, however, these were not ascribed to the outfall but rather to the slightly different water mass properties across Knik Arm at the control site. No significant differences were seen for dissolved oxygen, turbidity, color, fecal coliform, or TRC.
- Fecal coliform concentrations in receiving water and intertidal samples were found to be very low at all stations. AWQS criteria of a median of not more than 14 FC MPN/100 mL, a geometric mean of not more than 20 FC MPN/100 mL, and of not more than 10 % of the samples exceeding 40 FC MPN/100 mL were met at all receiving water locations.
- Supplemental receiving water quality samples obtained as part of the plume dispersion monitoring indicated that dissolved metals were all below the site-specific AWQS. None of the dissolved metals exceeded the AWQS at the diffuser or control locations and no significant differences between the outfall and control sites were seen for dissolved metals. Total recoverable metals were elevated compared to the dissolved as a result of the high suspended sediment load. Statistically significant differences were seen between the outfall and control sites for most total recoverable metals as a result of the higher TSS and metals concentrations at the control site and were not ascribed to the outfall.
- All cyanide concentrations in the receiving waters (outfall and control locations) were found to be below the receiving water quality criterion limit of 1.0 µg/L and no statistically significant differences were detected between concentrations at the control and outfall stations.
- Supplemental receiving water samples also demonstrated that TAH and TAqH met the AWQS at all locations. No statistically significant differences were detected between the control and outfall sites for either TAH or TAqH.
- Turbidity met the AWQS criteria at all stations. TRC was at or below 100 µg/L at all locations, as compared to the AWQS of 7.5 µg/L for chronic and 13.0 µg/L for acute marine water use. Due to seawater matrix interferences, the lowest level detection for TRC that was achievable in 2008 is higher than the AWQS, therefore it could not be determined if this standard was met at all sites. Color was found to meet the AWQS of not exceeding natural conditions for all samples and was always <5 color units.

## CONCLUSIONS

Results from this year of the monitoring program confirm previous studies, data in the 301(h) waiver application, and the decision by the EPA to reissue the permit. The Asplund WPCF is operating within regulatory requirements with no exceptions seen in 2008 and is showing no measurable impacts to the marine environment.



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